

PREDICTED ENERGY ASSESSMENT

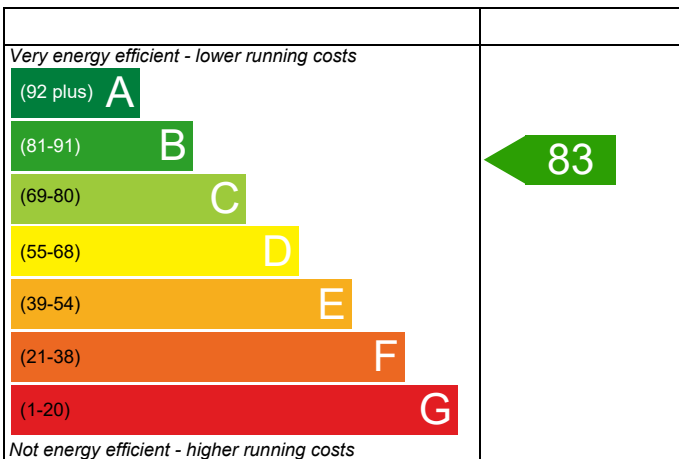
Plot 36

Dwelling type: House, Semi-Detached
 Date of assessment: 23/09/2022
 Produced by: Gareth Thomas
 Total floor area: 77 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.

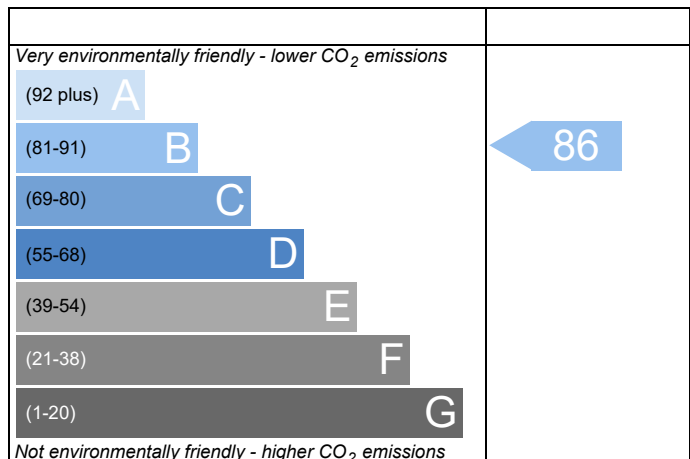
Energy Efficiency Rating



England EU Directive 2002/91/EC

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.

Environmental Impact (CO₂) Rating



England EU Directive 2002/91/EC

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	036 - PRJ012701			Issued on Date	23/09/2022
Assessment Reference	036 S	Prop Type Ref	2D		
Property	Plot 36				
SAP Rating	83 B	DER	18.12	TER	18.76
Environmental	86 B	% DER<TER	3.39		
CO ₂ Emissions (t/year)	1.16	DFEE	47.21	TFEE	52.66
General Requirements Compliance	Pass	% DFEE<TFEE	10.36		
Assessor Details	Chris Nicholls, , Tel: ,			Assessor ID	W933-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 77 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) 18.76 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.12 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 47.2 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	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Data from database

Ideal LOGIC COMBI ESP1 30

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0%

OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading:

Average

Windows facing South East: 7.39 m², No overhang

Windows facing North West: 4.75 m², No overhang

Air change rate: 4.21 ach

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

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.10 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	38.5000 (1b)	2.4000 (2b)	92.4000 (1b) - (3b)
First floor	38.5000 (1c)	2.7600 (2c)	106.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 198.6600 (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) =	0.1510 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.4015 (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) =	0.3714 (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	0.4735	0.4642	0.4550	0.4085	0.3993	0.3528	0.3528	0.3435	0.3714	0.3993	0.4178	0.4364 (22b)
Effective ac	0.6121	0.6078	0.6035	0.5835	0.5797	0.5622	0.5622	0.5590	0.5690	0.5797	0.5873	0.5952 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.40)			12.1400	1.3258	16.0947		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			38.4990	0.1500	5.7749	75.6000	2910.5244 (28a)
Wl - Brick	88.0360	12.9650	75.0710	0.2500	18.7678	51.1800	3842.1338 (29a)
Wl - Render	2.5470	1.3100	1.2370	0.2500	0.3093	51.1800	63.3097 (29a)
Rf - Ins Joist	38.4990		38.4990	0.1000	3.8499	5.8200	224.0642 (30)
Total net area of external elements Aum(A, m2)			167.5760				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.3524		(33)
Party Wall			44.1740	0.0000	0.0000	54.0300	2386.7212 (32)
Ground Floor Stud			65.0160			5.8200	378.3931 (32c)
1st Floor Stud			103.2350			5.8200	600.8279 (32c)
Internal Floor			38.5000			18.0000	693.0000 (32d)
Internal Ceiling			38.5000			5.8200	224.0700 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11323.0443 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.0525 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3766 (36)
Total fabric heat loss							(33) + (36) = 56.7291 (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	40.1290	39.8436	39.5638	38.2498	38.0040	36.8595	36.8595	36.6475	37.3003	38.0040	38.5013	39.0213 (38)
Average = Sum(39)m / 12 =	96.8581	96.5727	96.2929	94.9789	94.7330	93.5886	93.5886	93.3766	94.0294	94.7330	95.2304	95.7504 (39)
HLP	1.2579	1.2542	1.2506	1.2335	1.2303	1.2154	1.2154	1.2127	1.2212	1.2303	1.2368	1.2435 (40)
HLP (average)												1.2335 (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												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1436.2293 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6636	13.2191	14.5923	14.0727	14.5063	13.9974	14.4385	14.4825	14.0384	14.5567	14.1438	14.6495	(61)
Total heat required for water heating calculated for each month	163.5699	143.4535	148.9825	131.2374	126.9286	111.0093	104.3342	117.6391	118.4272	136.2117	146.9397	158.8573	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)	
Output from w/h	163.5699	143.4535	148.9825	131.2374	126.9286	111.0093	104.3342	117.6391	118.4272	136.2117	146.9397	158.8573	(64)
Total per year (kWh/year) = Sum(64)m =												1607.5902 (64)	
Heat gains from water heating, kWh/month	53.1772	46.6077	48.3328	42.4754	41.0070	35.7558	33.5000	37.9202	38.2189	44.0895	47.6906	51.6115	(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	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8733	17.6513	14.3550	10.8677	8.1237	6.8584	7.4107	9.6327	12.9290	16.4164	19.1603	20.4257	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	213.0566	215.2674	209.6961	197.8355	182.8636	168.7921	159.3915	157.1806	162.7519	174.6125	189.5845	203.6559	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	(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)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	(71)
Water heating gains (Table 5)	71.4748	69.3567	64.9635	58.9936	55.1169	49.6608	45.0268	50.9680	53.0817	59.2600	66.2369	69.3702	(72)
Total internal gains	366.4568	364.3276	351.0667	329.7489	308.1563	287.3634	273.8811	279.8335	290.8148	312.3411	337.0338	355.5040	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Southeast		7.3900	36.7938	0.5000	0.0000	0.7700	104.6840 (77)						
Northwest		4.7530	11.2829	0.5000	0.0000	0.7700	20.6467 (81)						
Solar gains	125.3307	220.3425	319.6983	426.6547	505.7578	514.3591	490.7956	429.9070	356.4428	248.4370	151.3662	106.4488	(83)
Total gains	491.7875	584.6701	670.7651	756.4036	813.9142	801.7225	764.6767	709.7404	647.2576	560.7780	488.4000	461.9528	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.4732	32.5691	32.6638	33.1157	33.2016	33.6076	33.6076	33.6839	33.4501	33.2016	33.0282	32.8489	
alpha	3.1649	3.1713	3.1776	3.2077	3.2134	3.2405	3.2405	3.2456	3.2300	3.2134	3.2019	3.1899	
util living area	0.9838	0.9715	0.9469	0.8921	0.7919	0.6436	0.5025	0.5521	0.7645	0.9223	0.9737	0.9866	(86)
MIT	19.0079	19.2643	19.6601	20.1609	20.5815	20.8525	20.9510	20.9330	20.7268	20.1716	19.5013	18.9666	(87)
Th 2	19.8740	19.8769	19.8798	19.8933	19.8958	19.9077	19.9077	19.9099	19.9031	19.8958	19.8907	19.8853	(88)
util rest of house	0.9804	0.9655	0.9355	0.8680	0.7444	0.5621	0.3917	0.4407	0.6948	0.8999	0.9672	0.9838	(89)
MIT 2	18.0705	18.3258	18.7163	19.2079	19.5939	19.8257	19.8898	19.8833	19.7329	19.2303	18.5731	18.0379	(90)
Living area fraction												fLA = Living area / (4) = 0.2410 (91)	
MIT	18.2965	18.5520	18.9438	19.4376	19.8320	20.0732	20.1456	20.1363	19.9725	19.4572	18.7968	18.2617	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.1465	18.4020	18.7938	19.2876	19.6820	19.9232	19.9956	19.9863	19.8225	19.3072	18.6468	18.1117	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9731	0.9551	0.9214	0.8522	0.7339	0.5633	0.4011	0.4491	0.6889	0.8847	0.9572	0.9775	(94)
Useful gains	478.5694	558.4018	618.0442	644.5807	597.3127	451.6373	306.7296	318.7655	445.9172	496.1012	467.5179	451.5370	(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	1341.1434	1303.9257	1183.8043	986.6042	756.1579	498.1929	317.7893	334.8789	538.0806	824.8614	1099.6088	1332.0526	(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	641.7551	500.9921	420.9255	246.2569	118.1808	0.0000	0.0000	0.0000	0.0000	244.5976	455.1054	655.1036	(98)
Space heating												3282.9170 (98)	
Space heating per m ²												(98) / (4) = 42.6353 (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

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													3627.5326 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	641.7551	500.9921	420.9255	246.2569	118.1808	0.0000	0.0000	0.0000	0.0000	244.5976	455.1054	655.1036	(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)	709.1216	553.5824	465.1111	272.1071	130.5865	0.0000	0.0000	0.0000	0.0000	270.2736	502.8789	723.8714	(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	163.5699	143.4535	148.9825	131.2374	126.9286	111.0093	104.3342	117.6391	118.4272	136.2117	146.9397	158.8573	(64)
Efficiency of water heater (217)m	89.8312	89.7675	89.6410	89.3612	88.8142	87.3000	87.3000	87.3000	87.3000	89.3288	89.6975	87.3000	(216)
Fuel for water heating, kWh/month	182.0858	159.8055	166.1990	146.8616	142.9148	127.1584	119.5123	134.7527	135.6554	152.4835	163.8169	176.7887	(219)
Water heating fuel used													1808.0345 (219)
Annual totals kWh/year													
Space heating fuel - main system													3627.5326 (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)													350.9694 (232)
Total delivered energy for all uses													5861.5365 (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	3627.5326	0.2160	783.5470 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1808.0345	0.2160	390.5355 (264)
Space and water heating			1174.0825 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	350.9694	0.5190	182.1531 (268)
Total CO2, kg/year			1395.1606 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.1200 (273)

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

	DER	TFA	N	EF	
Total Floor Area		18.1200			ZC1
Assumed number of occupants		77.0000			
CO2 emission factor in Table 12 for electricity displaced from grid		2.4035			
CO2 emissions from appliances, equation (L14)		0.5190			
CO2 emissions from cooking, equation (L16)		16.3965			ZC2
Total CO2 emissions		2.2946			ZC3
Residual CO2 emissions offset from biofuel CHP		36.8111			ZC4
Additional allowable electricity generation, kWh/m ² /year		0.0000			ZC5
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000			ZC6
Net CO2 emissions		0.0000			ZC7
		36.8111			ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	38.5000 (1b)	2.4000 (2b)	92.4000 (1b) - (3b)
First floor	38.5000 (1c)	2.7600 (2c)	106.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 198.6600 (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) =	0.1510 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4010 (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) =	0.3709 (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	0.4729	0.4637	0.4544	0.4080	0.3988	0.3524	0.3524	0.3431	0.3709	0.3988	0.4173	0.4358 (22b)
Effective ac	0.6118	0.6075	0.6032	0.5832	0.5795	0.5621	0.5621	0.5589	0.5688	0.5795	0.5871	0.5950 (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			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			12.1400	1.3258	16.0947		(27)					
Flr - Ground			38.4990	0.1300	5.0049		(28a)					
Wl - Brick	88.0360	12.9650	75.0710	0.1800	13.5128		(29a)					
Wl - Render	2.5470	1.3100	1.2370	0.1800	0.2227		(29a)					
Rf - Ins Joist	38.4990		38.4990	0.1300	5.0049		(30)					
Total net area of external elements Aum(A, m2)			167.5760				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		41.9699 (33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7091 (36)					
Total fabric heat loss							(33) + (36) = 50.6790 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.1107	Feb 39.8260	Mar 39.5470	Apr 38.2362	May 37.9910	Jun 36.8493	Jul 36.8493	Aug 36.6379	Sep 37.2891	Oct 37.9910	Nov 38.4871	Dec 39.0057 (38)
Heat transfer coeff	90.7897	90.5050	90.2259	88.9152	88.6699	87.5283	87.5283	87.3169	87.9680	88.6699	89.1661	89.6847 (39)
Average = Sum(39)m / 12 =												88.9140 (39)
HLP	Jan 1.1791	Feb 1.1754	Mar 1.1718	Apr 1.1547	May 1.1516	Jun 1.1367	Jul 1.1367	Aug 1.1340	Sep 1.1424	Oct 1.1516	Nov 1.1580	Dec 1.1647 (40)
HLP (average)												1.1547 (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												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Energy content (annual)												Total = Sum(45)m = 1436.2293 (45)
Distribution loss (46)m = 0.15 x (45)m	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	44.5359	47.4469	44.1157	43.7256	40.5144	41.8649	43.7256	44.1157	47.4469	47.7170	50.9589	50.9589	47.7170	47.7170	(61)
Total heat required for water heating calculated for each month	199.8652	174.7702	181.8371	161.2803	156.1478	137.5263	131.7607	146.8823	148.5044	169.1019	180.5129	195.1667	195.1667	180.5129	180.5129	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	199.8652	174.7702	181.8371	161.2803	156.1478	137.5263	131.7607	146.8823	148.5044	169.1019	180.5129	195.1667	195.1667	180.5129	180.5129	(64)
Heat gains from water heating, kWh/month	62.2511	54.4369	56.5465	49.9862	48.3118	42.3850	40.3566	45.2310	45.7382	52.3120	56.0839	60.6888	60.6888	56.0839	56.0839	(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	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8733	17.6513	14.3550	10.8677	8.1237	6.8584	7.4107	9.6327	12.9290	16.4164	19.1603	20.4257	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	213.0566	215.2674	209.6961	197.8355	182.8636	168.7921	159.3915	157.1806	162.7519	174.6125	189.5845	203.6559	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	(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)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	(71)
Water heating gains (Table 5)	83.6708	81.0073	76.0033	69.4252	64.9352	58.8681	54.2427	60.7943	63.5252	70.3118	77.8943	81.5710	(72)
Total internal gains	378.6528	375.9781	362.1066	340.1805	317.9746	296.5707	283.0970	289.6598	301.2583	323.3929	348.6912	367.7047	(73)

6. Solar gains

[Jan]	Area	Solar flux	Specific data	g	Specific data	FF	Access	Gains					
	m ²	Table 6a	or Table 6b	W/m ²	or Table 6c	or Table 6c	factor	W					
							Table 6d						
Southeast	7.3900	36.7938	0.6300	0.6300	0.7000	0.7700	83.0981	(77)					
Northwest	4.7530	11.2829	0.6300	0.6300	0.7000	0.7700	16.3894	(81)					
Solar gains	99.4875	174.9079	253.7765	338.6785	401.4706	408.2983	389.5935	341.2601	282.9443	197.2093	120.1545	84.4991	(83)
Total gains	478.1403	550.8860	615.8831	678.8590	719.4452	704.8690	672.6905	630.9199	584.2026	520.6021	468.8457	452.2038	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	58.8968	59.0821	59.2648	60.1385	60.3048	61.0914	61.0914	61.2393	60.7860	60.3048	59.9693	59.6224		
alpha	4.9265	4.9388	4.9510	5.0092	5.0203	5.0728	5.0728	5.0826	5.0524	5.0203	4.9980	4.9748		
util living area	0.9977	0.9949	0.9872	0.9608	0.8852	0.7271	0.5576	0.6117	0.8503	0.9745	0.9952	0.9982	(86)	
MIT	19.7392	19.8963	20.1492	20.4837	20.7711	20.9417	20.9877	20.9808	20.8654	20.4942	20.0588	19.7163	(87)	
Th 2	19.9368	19.9397	19.9427	19.9564	19.9589	19.9709	19.9709	19.9732	19.9663	19.9589	19.9537	19.9483	(88)	
util rest of house	0.9969	0.9931	0.9825	0.9457	0.8412	0.6358	0.4348	0.4874	0.7791	0.9618	0.9932	0.9976	(89)	
MIT 2	18.2610	18.4922	18.8612	19.3476	19.7319	19.9317	19.9664	19.9652	19.8573	19.3712	18.7399	18.2357	(90)	
Living area fraction	fLA = Living area / (4) =												0.2410	(91)
MIT	18.6173	18.8306	19.1717	19.6215	19.9824	20.1751	20.2126	20.2100	20.1003	19.6418	19.0578	18.5926	(92)	
Temperature adjustment													0.0000	
adjusted MIT	18.6173	18.8306	19.1717	19.6215	19.9824	20.1751	20.2126	20.2100	20.1003	19.6418	19.0578	18.5926	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Useful gains	475.9436	545.6511	602.2559	637.8510	606.0275	461.9426	312.5238	326.4693	461.3638	498.0350	464.4884	450.6090	(94)		
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	(95)		
Heat loss rate W	1299.8674	1260.7918	1143.3144	953.2998	734.3995	487.9817	316.2011	332.6756	527.8358	801.7399	1066.2309	1290.7971	(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	612.9993	480.5745	402.5476	227.1231	95.5088	0.0000	0.0000	0.0000	0.0000	225.9565	433.2546	625.1000	(98)		
Space heating													3103.0643	(98)	
Space heating per m ²													(98) / (4) =	40.2995	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3322.3387 (211)
Space heating requirement	612.9993	480.5745	402.5476	227.1231	95.5088	0.0000	0.0000	0.0000	0.0000	225.9565	433.2546	625.1000	(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)	656.3162	514.5338	430.9931	243.1725	102.2578	0.0000	0.0000	0.0000	0.0000	241.9234	463.8700	669.2719	(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	199.8652	174.7702	181.8371	161.2803	156.1478	137.5263	131.7607	146.8823	148.5044	169.1019	180.5129	195.1667	(64)
Efficiency of water heater (217)m	87.6881	87.4661	86.9953	85.9129	83.8557	80.3000	80.3000	80.3000	80.3000	85.7816	87.1752	80.3000	(216)
Fuel for water heating, kWh/month	227.9272	199.8148	209.0196	187.7253	186.2102	171.2656	164.0855	182.9169	184.9370	197.1306	207.0691	222.3532	(219)
Water heating fuel used													2340.4551 (219)
Annual totals kWh/year													
Space heating fuel - main system													3322.3387 (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)													350.9694 (232)
Total delivered energy for all uses													6088.7631 (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	3322.3387	0.2160	717.6252 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2340.4551	0.2160	505.5383 (264)
Space and water heating			1223.1635 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	350.9694	0.5190	182.1531 (268)
Total CO2, kg/m2/year			1444.2416 (272)
Emissions per m2 for space and water heating			15.8852 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3656 (272b)
Emissions per m2 for pumps and fans			0.5055 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8852 * 1.00) + 2.3656 + 0.5055, rounded to 2 d.p.			18.7600 (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	38.5000 (1b)	2.4000 (2b)	92.4000 (1b) - (3b)
First floor	38.5000 (1c)	2.7600 (2c)	106.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 198.6600 (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) =	0.1510 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4015 (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) =	0.3714 (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	0.4735	0.4642	0.4550	0.4085	0.3993	0.3528	0.3528	0.3435	0.3714	0.3993	0.4178	0.4364 (22b)
	0.6121	0.6078	0.6035	0.5835	0.5797	0.5622	0.5622	0.5590	0.5690	0.5797	0.5873	0.5952 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.40)			12.1400	1.3258	16.0947		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			38.4990	0.1500	5.7749	75.6000	2910.5244 (28a)
Wl - Brick	88.0360	12.9650	75.0710	0.2500	18.7678	51.1800	3842.1338 (29a)
Wl - Render	2.5470	1.3100	1.2370	0.2500	0.3093	51.1800	63.3097 (29a)
Rf - Ins Joist	38.4990		38.4990	0.1000	3.8499	5.8200	224.0642 (30)
Total net area of external elements Aum(A, m2)			167.5760				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	47.3524	(33)
Party Wall			44.1740	0.0000	0.0000	54.0300	2386.7212 (32)
Ground Floor Stud			65.0160			5.8200	378.3931 (32c)
1st Floor Stud			103.2350			5.8200	600.8279 (32c)
Internal Floor			38.5000			18.0000	693.0000 (32d)
Internal Ceiling			38.5000			5.8200	224.0700 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11323.0443 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.0525 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3766 (36)
Total fabric heat loss							(33) + (36) = 56.7291 (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	40.1290	39.8436	39.5638	38.2498	38.0040	36.8595	36.8595	36.6475	37.3003	38.0040	38.5013	39.0213 (38)
Average = Sum(39)m / 12 =	96.8581	96.5727	96.2929	94.9789	94.7330	93.5886	93.5886	93.3766	94.0294	94.7330	95.2304	95.7504 (39)
												94.9777 (39)
HLP	1.2579	1.2542	1.2506	1.2335	1.2303	1.2154	1.2154	1.2127	1.2212	1.2303	1.2368	1.2435 (40)
HLP (average)												1.2335 (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												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1436.2293 (45)							
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water storage loss:																					
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Heat gains from water heating, kWh/month	31.6426	27.6748	28.5579	24.8975	23.8897	20.6150	19.1028	21.9208	22.1826	25.8517	28.2191	30.6441	65								

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	19.8733	17.6513	14.3550	10.8677	8.1237	6.8584	7.4107	9.6327	12.9290	16.4164	19.1603	20.4257	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	213.0566	215.2674	209.6961	197.8355	182.8636	168.7921	159.3915	157.1806	162.7519	174.6125	189.5845	203.6559	(68)
Pumps, fans	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	(71)
Total internal gains	42.5303	41.1827	38.3843	34.5798	32.1099	28.6320	25.6759	29.4634	30.8092	34.7469	39.1932	41.1884	(72)
	334.5124	333.1536	321.4876	302.3351	282.1493	263.3346	251.5302	255.3289	265.5422	284.8279	306.9901	324.3221	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m ²	Table 6a	Specific data	Specific data	factor	W							
		W/m ²	or Table 6b	or Table 6c	Table 6d								
Southeast	7.3900	36.7938	0.5000	0.0000	0.7700	104.6840 (77)							
Northwest	4.7530	11.2829	0.5000	0.0000	0.7700	20.6467 (81)							
Solar gains	125.3307	220.3425	319.6983	426.6547	505.7578	514.3591	490.7956	429.9070	356.4428	248.4370	151.3662	106.4488	(83)
Total gains	459.8430	553.4961	641.1859	728.9898	787.9071	777.6937	742.3258	685.2358	621.9851	533.2649	458.3563	430.7709	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	32.4732	32.5691	32.6638	33.1157	33.2016	33.6076	33.6076	33.6839	33.4501	33.2016	33.0282	32.8489	
util living area	3.1649	3.1713	3.1776	3.2077	3.2134	3.2405	3.2405	3.2456	3.2300	3.2134	3.2019	3.1899	
	0.9866	0.9753	0.9526	0.9004	0.8034	0.6568	0.5149	0.5673	0.7795	0.9310	0.9778	0.9890	(86)
MIT	18.9549	19.2148	19.6171	20.1284	20.5610	20.8433	20.9474	20.9274	20.7090	20.1349	19.4530	18.9141	(87)
Th 2	19.8740	19.8769	19.8798	19.8933	19.8958	19.9077	19.9077	19.9099	19.9031	19.8958	19.8907	19.8853	(88)
util rest of house	0.9837	0.9701	0.9422	0.8777	0.7570	0.5753	0.4024	0.4545	0.7114	0.9105	0.9723	0.9867	(89)
MIT 2	18.0182	18.2773	18.6751	19.1783	19.5773	19.8200	19.8884	19.8808	19.7201	19.1965	18.5258	17.9859	(90)
Living area fraction	18.2440	18.5033	18.9021	19.4073	19.8144	20.0666	20.1436	20.1331	19.9584	19.4227	18.7493	18.2097	(92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
adjusted MIT	18.2440	18.5033	18.9021	19.4073	19.8144	20.0666	20.1436	20.1331	19.9584	19.4227	18.7493	18.2097	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9780	0.9616	0.9307	0.8658	0.7532	0.5881	0.4280	0.4792	0.7153	0.8994	0.9645	0.9817	(94)
Ext temp.	449.7070	532.2603	596.7277	631.1436	593.4292	457.3641	317.7067	328.3395	444.9300	479.6423	442.0889	422.8984	(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	1350.5848	1313.7070	1194.2368	997.9724	768.7047	511.6125	331.6430	348.5849	550.8657	835.8024	1109.3702	1341.4317	(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 per m2	670.2531	525.1322	444.5468	264.1167	130.4050	0.0000	0.0000	0.0000	0.0000	264.9831	480.4425	683.3888	(98)
												3463.2681 (98)	
												44.9775 (99)	

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	879.7325	692.5554	709.6623	0.0000	0.0000	0.0000	0.0000	(100)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.8102	0.8698	0.8429	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	712.7492	602.3782	598.1395	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	998.7992	955.6514	890.5256	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	205.9560	262.8353	217.5353	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												686.3266 (104)
Intermittency factor (Table 10b)												FC = cooled area / (4) = 1.0000 (105)
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	51.4890	65.7088	54.3838	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												171.5817 (107)
Energy for space heating												2.2283 (108)
Energy for space cooling												44.9775 (99)
Total												2.2283 (108)
Dwelling Fabric Energy Efficiency (DFEE)												47.2058 (109)
												47.2 (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	38.5000 (1b)	2.4000 (2b)	92.4000 (1b) - (3b)
First floor	38.5000 (1c)	2.7600 (2c)	106.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 198.6600 (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) =	0.1510 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4010 (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) =	0.3709 (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	0.4729	0.4637	0.4544	0.4080	0.3988	0.3524	0.3524	0.3431	0.3709	0.3988	0.4173	0.4358 (22b)
Effective ac	0.6118	0.6075	0.6032	0.5832	0.5795	0.5621	0.5621	0.5589	0.5688	0.5795	0.5871	0.5950 (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			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			12.1400	1.3258	16.0947		(27)					
Flr - Ground			38.4990	0.1300	5.0049		(28a)					
Wl - Brick	88.0360	12.9650	75.0710	0.1800	13.5128		(29a)					
Wl - Render	2.5470	1.3100	1.2370	0.1800	0.2227		(29a)					
Rf - Ins Joist	38.4990		38.4990	0.1300	5.0049		(30)					
Total net area of external elements Aum(A, m2)			167.5760				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		41.9699 (33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7091 (36)					
Total fabric heat loss							(33) + (36) = 50.6790 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.1107	Feb 39.8260	Mar 39.5470	Apr 38.2362	May 37.9910	Jun 36.8493	Jul 36.8493	Aug 36.6379	Sep 37.2891	Oct 37.9910	Nov 38.4871	Dec 39.0057 (38)
Heat transfer coeff	90.7897	90.5050	90.2259	88.9152	88.6699	87.5283	87.5283	87.3169	87.9680	88.6699	89.1661	89.6847 (39)
Average = Sum(39)m / 12 =												88.9140 (39)
HLP	Jan 1.1791	Feb 1.1754	Mar 1.1718	Apr 1.1547	May 1.1516	Jun 1.1367	Jul 1.1367	Aug 1.1340	Sep 1.1424	Oct 1.1516	Nov 1.1580	Dec 1.1647 (40)
HLP (average)												1.1547 (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												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Energy content (annual)												Total = Sum(45)m = 1436.2293 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	31.6426	27.6748	28.5579	24.8975	23.8897	20.6150	19.1028	21.9208	22.1826	25.8517	28.2191	30.6441	(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	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8733	17.6513	14.3550	10.8677	8.1237	6.8584	7.4107	9.6327	12.9290	16.4164	19.1603	20.4257	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	213.0566	215.2674	209.6961	197.8355	182.8636	168.7921	159.3915	157.1806	162.7519	174.6125	189.5845	203.6559	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	(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)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	(71)
Water heating gains (Table 5)	42.5303	41.1827	38.3843	34.5798	32.1099	28.6320	25.6759	29.4634	30.8092	34.7469	39.1932	41.1884	(72)
Total internal gains	334.5124	333.1536	321.4876	302.3351	282.1493	263.3346	251.5302	255.3289	265.5422	284.8279	306.9901	324.3221	(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						
Southeast	7.3900	36.7938	0.6300	0.7000	0.7700	83.0981 (77)						
Northwest	4.7530	11.2829	0.6300	0.7000	0.7700	16.3894 (81)						
Solar gains	99.4875	174.9079	253.7765	338.6785	401.4706	408.2983	389.5935	341.2601	282.9443	197.2093	120.1545	84.4991 (83)
Total gains	433.9999	508.0615	575.2641	641.0136	683.6198	671.6328	641.1237	596.5890	548.4865	482.0372	427.1446	408.8212 (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)	58.8968	59.0821	59.2648	60.1385	60.3048	61.0914	61.0914	61.2393	60.7860	60.3048	59.9693	59.6224	21.0000 (85)
alpha	4.9265	4.9388	4.9510	5.0092	5.0203	5.0728	5.0728	5.0826	5.0524	5.0203	4.9980	4.9748	
util living area	0.9985	0.9964	0.9903	0.9684	0.9014	0.7515	0.5818	0.6409	0.8740	0.9812	0.9968	0.9989	(86)
MIT	19.6862	19.8455	20.1027	20.4454	20.7459	20.9322	20.9852	20.9764	20.8442	20.4523	20.0091	19.6640	(87)
Th 2	19.9368	19.9397	19.9427	19.9564	19.9589	19.9709	19.9709	19.9732	19.9663	19.9589	19.9537	19.9483	(88)
util rest of house	0.9980	0.9952	0.9868	0.9558	0.8612	0.6611	0.4553	0.5135	0.8083	0.9715	0.9955	0.9985	(89)
MIT 2	18.7398	18.9010	19.1588	19.5050	19.7839	19.9391	19.9671	19.9663	19.8775	19.5181	19.0757	18.7268	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	18.9680	19.1287	19.3863	19.7316	20.0158	20.1784	20.2125	20.2098	20.1105	19.7433	19.3007	18.9527	(92)
Temperature adjustment	0.0000												
adjusted MIT	18.9680	19.1287	19.3863	19.7316	20.0158	20.1784	20.2125	20.2098	20.1105	19.7433	19.3007	18.9527	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9938	0.9843	0.9524	0.8638	0.6810	0.4862	0.5446	0.8191	0.9688	0.9943	0.9980	(94)
Useful gains	432.8303	504.9364	566.2065	610.4741	590.4970	457.3646	311.6931	324.8747	449.2643	467.0115	424.7102	408.0009	(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	1331.6996	1287.7672	1162.6794	963.0972	737.3581	488.2720	316.1962	332.6565	528.7348	810.7333	1087.8891	1323.0922	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	668.7587	526.0623	443.7758	253.8886	109.2647	0.0000	0.0000	0.0000	0.0000	255.7290	477.4889	680.8279	(98)
Space heating	3415.7959 (98)												
Space heating per m2	(98) / (4) = 44.3610 (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	822.7660	647.7094	663.6083	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8599	0.9221	0.8979	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	707.4582	597.2269	595.8475	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	874.8320	837.3633	786.9125	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	120.5091	178.6615	142.1523	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling	441.3229 (104)												

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Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	30.1273	44.6654	35.5381	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											110.3307 (107)	
Space cooling per m2											1.4329 (108)	
Energy for space heating											44.3610 (99)	
Energy for space cooling											1.4329 (108)	
Total											45.7939 (109)	
Target Fabric Energy Efficiency (TFEE)											52.7 (109)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	38.5000 (1b)	2.4000 (2b)	92.4000 (1b) - (3b)
First floor	38.5000 (1c)	2.7600 (2c)	106.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 198.6600 (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) =	0.1510 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.4015 (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) =	0.3714 (21)							
Wind speed	Jan 4.2000	Feb 4.0000	Mar 4.0000	Apr 3.7000	May 3.7000	Jun 3.3000	Jul 3.4000	Aug 3.2000	Sep 3.3000	Oct 3.5000	Nov 3.5000	Dec 3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3900	0.3714	0.3714	0.3435	0.3435	0.3064	0.3157	0.2971	0.3064	0.3250	0.3250	0.3528 (22b)
	0.5760	0.5690	0.5690	0.5590	0.5590	0.5469	0.5498	0.5441	0.5469	0.5528	0.5528	0.5622 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.40)			12.1400	1.3258	16.0947		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			38.4990	0.1500	5.7749	75.6000	2910.5244 (28a)
Wl - Brick	88.0360	12.9650	75.0710	0.2500	18.7678	51.1800	3842.1338 (29a)
Wl - Render	2.5470	1.3100	1.2370	0.2500	0.3093	51.1800	63.3097 (29a)
Rf - Ins Joist	38.4990		38.4990	0.1000	3.8499	5.8200	224.0642 (30)
Total net area of external elements Aum(A, m2)			167.5760				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	47.3524	(33)
Party Wall			44.1740	0.0000	0.0000	54.0300	2386.7212 (32)
Ground Floor Stud			65.0160			5.8200	378.3931 (32c)
1st Floor Stud			103.2350			5.8200	600.8279 (32c)
Internal Floor			38.5000			18.0000	693.0000 (32d)
Internal Ceiling			38.5000			5.8200	224.0700 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11323.0443 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.0525 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3766 (36)
Total fabric heat loss							(33) + (36) = 56.7291 (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	37.7638	37.3003	37.3003	36.6475	36.6475	35.8563	36.0456	35.6726	35.8563	36.2406	36.2406	36.8595 (38)
Average = Sum(39)m / 12 =	94.4928	94.0294	94.0294	93.3766	93.3766	92.5854	92.7747	92.4017	92.5854	92.9697	92.9697	93.5886 (39)
												93.2650 (39)
HLP	1.2272	1.2212	1.2212	1.2127	1.2127	1.2024	1.2049	1.2000	1.2024	1.2074	1.2074	1.2154 (40)
HLP (average)												1.2112 (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												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1436.2293 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6636	13.2191	14.5923	14.0727	14.5063	13.9974	14.4385	14.4825	14.0384	14.5567	14.1438	14.6495	(61)
Total heat required for water heating calculated for each month	163.5699	143.4535	148.9825	131.2374	126.9286	111.0093	104.3342	117.6391	118.4272	136.2117	146.9397	158.8573	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)	
Output from w/h	163.5699	143.4535	148.9825	131.2374	126.9286	111.0093	104.3342	117.6391	118.4272	136.2117	146.9397	158.8573	(64)
Total per year (kWh/year) = Sum(64)m =												1607.5902 (64)	
RHI water heating demand												1608 (64)	
Heat gains from water heating, kWh/month	53.1772	46.6077	48.3328	42.4754	41.0070	35.7558	33.5000	37.9202	38.2189	44.0895	47.6906	51.6115	(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	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.6833	44.1283	35.8876	27.1692	20.3093	17.1460	18.5268	24.0818	32.3226	41.0410	47.9009	51.0642	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	317.9949	321.2947	312.9793	295.2769	272.9307	251.9285	237.8977	234.5979	242.9133	260.6157	282.9619	303.9641	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	(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)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	(71)
Water heating gains (Table 5)	71.4748	69.3567	64.9635	58.9936	55.1169	49.6608	45.0268	50.9680	53.0817	59.2600	66.2369	69.3702	(72)
Total internal gains	542.0468	537.6735	516.7241	484.3335	451.2507	421.6291	404.3451	412.5416	431.2114	463.8105	499.9935	527.2923	(73)

6. Solar gains

[Jan]		Area	Solar flux	Specific data	Specific data	Access	Gains						
		m2	Table 6a	g	FF	factor	W						
			W/m2	or Table 6b	or Table 6c	Table 6d							
Southeast		7.3900	40.4699	0.5000	0.0000	0.7700	115.1430 (77)						
Northwest		4.7530	12.9236	0.5000	0.0000	0.7700	23.6489 (81)						
Solar gains	138.7919	219.9827	316.6327	437.9590	507.7863	553.4406	522.0745	466.2737	383.5243	265.1892	171.8028	116.7015	(83)
Total gains	680.8387	757.6562	833.3568	922.2925	959.0370	975.0696	926.4197	878.8152	814.7357	728.9998	671.7963	643.9938	(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	33.2860	33.4501	33.4501	33.6839	33.6839	33.9718	33.9025	34.0393	33.9718	33.8313	33.8313	33.6076	
alpha	3.2191	3.2300	3.2300	3.2456	3.2456	3.2648	3.2602	3.2693	3.2648	3.2554	3.2554	3.2405	
util living area	0.9556	0.9371	0.8956	0.8070	0.6619	0.4519	0.3057	0.3301	0.5898	0.8291	0.9285	0.9613	(86)
MIT	19.4911	19.6905	20.0553	20.4804	20.8004	20.9603	20.9921	20.9900	20.8993	20.5201	19.9585	19.4558	(87)
Th 2	19.8983	19.9031	19.9031	19.9099	19.9099	19.9181	19.9161	19.9200	19.9181	19.9141	19.9141	19.9077	(88)
util rest of house	0.9469	0.9250	0.8750	0.7695	0.5981	0.3626	0.2010	0.2216	0.5012	0.7869	0.9123	0.9535	(89)
MIT 2	18.5632	18.7603	19.1110	19.5098	19.7825	19.9017	19.9147	19.9180	19.8673	19.5591	19.0330	18.5363	(90)
Living area fraction												fLA = Living area / (4) =	
MIT	18.7869	18.9845	19.3386	19.7438	20.0278	20.1569	20.1744	20.1764	20.1161	19.7908	19.2561	18.7579	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6369	18.8345	19.1886	19.5938	19.8778	20.0069	20.0244	20.0264	19.9661	19.6408	19.1061	18.6079	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	635.8707	689.6477	715.9124	698.4063	571.6249	361.0168	196.0885	204.3498	411.7908	564.6275	602.7939	606.3266	(94)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1279.1368	1244.4313	1108.4757	905.1724	642.2267	370.9784	197.0886	205.7196	441.2667	747.5476	1032.5288	1264.1859	(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	478.5900	372.8146	292.0672	148.8716	52.5277	0.0000	0.0000	0.0000	0.0000	136.0926	309.4091	489.4473	(98)
Space heating												2279.8200 (98)	
RHI space heating demand												2280 (98)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	38.5000 (1b)	2.4000 (2b)	92.4000 (1b) - (3b)
First floor	38.5000 (1c)	2.7600 (2c)	106.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 198.6600 (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) =	0.1510 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4015 (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) =	0.3714 (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	0.4735	0.4642	0.4550	0.4085	0.3993	0.3528	0.3528	0.3435	0.3714	0.3993	0.4178	0.4364 (22b)
	0.6121	0.6078	0.6035	0.5835	0.5797	0.5622	0.5622	0.5590	0.5690	0.5797	0.5873	0.5952 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.40)			12.1400	1.3258	16.0947		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			38.4990	0.1500	5.7749	75.6000	2910.5244 (28a)
Wl - Brick	88.0360	12.9650	75.0710	0.2500	18.7678	51.1800	3842.1338 (29a)
Wl - Render	2.5470	1.3100	1.2370	0.2500	0.3093	51.1800	63.3097 (29a)
Rf - Ins Joist	38.4990		38.4990	0.1000	3.8499	5.8200	224.0642 (30)
Total net area of external elements Aum(A, m2)			167.5760				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	47.3524	(33)
Party Wall			44.1740	0.0000	0.0000	54.0300	2386.7212 (32)
Ground Floor Stud			65.0160			5.8200	378.3931 (32c)
1st Floor Stud			103.2350			5.8200	600.8279 (32c)
Internal Floor			38.5000			18.0000	693.0000 (32d)
Internal Ceiling			38.5000			5.8200	224.0700 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11323.0443 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.0525 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3766 (36)
Total fabric heat loss							(33) + (36) = 56.7291 (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	40.1290	39.8436	39.5638	38.2498	38.0040	36.8595	36.8595	36.6475	37.3003	38.0040	38.5013	39.0213 (38)
Average = Sum(39)m / 12 =	96.8581	96.5727	96.2929	94.9789	94.7330	93.5886	93.5886	93.3766	94.0294	94.7330	95.2304	95.7504 (39)
												94.9777 (39)
HLP	1.2579	1.2542	1.2506	1.2335	1.2303	1.2154	1.2154	1.2127	1.2212	1.2303	1.2368	1.2435 (40)
HLP (average)												1.2335 (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												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1436.2293 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6636	13.2191	14.5923	14.0727	14.5063	13.9974	14.4385	14.4825	14.0384	14.5567	14.1438	14.6495	(61)
Total heat required for water heating calculated for each month	163.5699	143.4535	148.9825	131.2374	126.9286	111.0093	104.3342	117.6391	118.4272	136.2117	146.9397	158.8573	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)	
Output from w/h	163.5699	143.4535	148.9825	131.2374	126.9286	111.0093	104.3342	117.6391	118.4272	136.2117	146.9397	158.8573	(64)
Total per year (kWh/year) = Sum(64)m =												1607.5902 (64)	
Heat gains from water heating, kWh/month	53.1772	46.6077	48.3328	42.4754	41.0070	35.7558	33.5000	37.9202	38.2189	44.0895	47.6906	51.6115	(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	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.6833	44.1283	35.8876	27.1692	20.3093	17.1460	18.5268	24.0818	32.3226	41.0410	47.9009	51.0642	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	317.9949	321.2947	312.9793	295.2769	272.9307	251.9285	237.8977	234.5979	242.9133	260.6157	282.9619	303.9641	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	(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)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	(71)
Water heating gains (Table 5)	71.4748	69.3567	64.9635	58.9936	55.1169	49.6608	45.0268	50.9680	53.0817	59.2600	66.2369	69.3702	(72)
Total internal gains	542.0468	537.6735	516.7241	484.3335	451.2507	421.6291	404.3451	412.5416	431.2114	463.8105	499.9935	527.2923	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Southeast		7.3900	36.7938	0.5000	0.0000	0.7700	104.6840	(77)					
Northwest		4.7530	11.2829	0.5000	0.0000	0.7700	20.6467	(81)					
Solar gains	125.3307	220.3425	319.6983	426.6547	505.7578	514.3591	490.7956	429.9070	356.4428	248.4370	151.3662	106.4488	(83)
Total gains	667.3775	758.0160	836.4224	910.9882	957.0085	935.9882	895.1407	842.4485	787.6543	712.2475	651.3596	633.7412	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.4732	32.5691	32.6638	33.1157	33.2016	33.6076	33.6076	33.6839	33.4501	33.2016	33.0282	32.8489	
alpha	3.1649	3.1713	3.1776	3.2077	3.2134	3.2405	3.2405	3.2456	3.2300	3.2134	3.2019	3.1899	
util living area	0.9634	0.9447	0.9108	0.8423	0.7302	0.5761	0.4392	0.4801	0.6850	0.8689	0.9447	0.9683	(86)
MIT	19.2875	19.5248	19.8831	20.3245	20.6775	20.8938	20.9669	20.9554	20.8062	20.3516	19.7484	19.2451	(87)
Th 2	19.8740	19.8769	19.8798	19.8933	19.8958	19.9077	19.9077	19.9099	19.9031	19.8958	19.8907	19.8853	(88)
util rest of house	0.9563	0.9342	0.8936	0.8115	0.6778	0.4964	0.3385	0.3777	0.6103	0.8364	0.9324	0.9621	(89)
MIT 2	18.3448	18.5785	18.9274	19.3541	19.6697	19.8506	19.8960	19.8929	19.7878	19.3916	18.8116	18.3117	(90)
Living area fraction												fLA = Living area / (4) = 0.2410 (91)	
MIT	18.5720	18.8066	19.1577	19.5880	19.9126	20.1021	20.1541	20.1490	20.0333	19.6230	19.0374	18.5367	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4220	18.6566	19.0077	19.4380	19.7626	19.9521	20.0041	19.9990	19.8833	19.4730	18.8874	18.3867	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9444	0.9198	0.8773	0.7969	0.6708	0.4999	0.3477	0.3865	0.6088	0.8216	0.9182	0.9511	(94)
Useful gains	630.2426	697.2401	733.8285	725.9603	641.9866	467.8583	311.2802	325.6215	479.5059	585.1540	598.0904	602.7689	(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	1367.8337	1328.5104	1204.4069	1000.8905	763.7979	500.8920	318.5874	336.0649	543.7988	840.5647	1122.5178	1358.3831	(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	548.7678	424.2136	350.1103	197.9498	90.6276	0.0000	0.0000	0.0000	0.0000	190.0255	377.5878	562.1770	(98)
Space heating												2741.4594 (98)	
Space heating per m ²												(98) / (4) = 35.6034 (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													3029.2369 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	548.7678	424.2136	350.1103	197.9498	90.6276	0.0000	0.0000	0.0000	0.0000	190.0255	377.5878	562.1770	(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)	606.3733	468.7444	386.8622	218.7290	100.1410	0.0000	0.0000	0.0000	0.0000	209.9729	417.2240	621.1900	(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	163.5699	143.4535	148.9825	131.2374	126.9286	111.0093	104.3342	117.6391	118.4272	136.2117	146.9397	158.8573	(64)
Efficiency of water heater (217)m	89.7446	89.6694	89.5205	89.1965	88.6051	87.3000	87.3000	87.3000	87.3000	89.1358	89.5801	87.3000	(216)
Fuel for water heating, kWh/month	182.2615	159.9804	166.4228	147.1328	143.2520	127.1584	119.5123	134.7527	135.6554	152.8136	164.0315	176.9505	(219)
Water heating fuel used													1809.9239 (219)
Annual totals kWh/year													
Space heating fuel - main system													3029.2369 (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)													350.9694 (232)
Total delivered energy for all uses													5265.1302 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3029.2369	3.4800	105.4174 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1809.9239	3.4800	62.9854 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	350.9694	13.1900	46.2929 (250)
Additional standing charges			120.0000 (251)
Total energy cost			344.5882 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1863 (257)
SAP value		83.4513
SAP rating (Section 12)		83 (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	3029.2369	0.2160	654.3152 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1809.9239	0.2160	390.9436 (264)
Space and water heating			1045.2587 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	350.9694	0.5190	182.1531 (268)
Total kg/year			1266.3368 (272)
CO2 emissions per m2			16.4500 (273)
EI value			86.0911
EI rating			86 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8870 = 3.923$, stars = 4
Water heating environmental impact	$0.216 / 0.8870 = 0.2435$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	38.5000 (1b)	2.4000 (2b)	92.4000 (1b) - (3b)
First floor	38.5000 (1c)	2.7600 (2c)	106.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 198.6600 (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) =	0.1510 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.4015 (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) =	0.3714 (21)							
Wind speed	Jan 4.2000	Feb 4.0000	Mar 4.0000	Apr 3.7000	May 3.7000	Jun 3.3000	Jul 3.4000	Aug 3.2000	Sep 3.3000	Oct 3.5000	Nov 3.5000	Dec 3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3900	0.3714	0.3714	0.3435	0.3435	0.3064	0.3157	0.2971	0.3064	0.3250	0.3250	0.3528 (22b)
	0.5760	0.5690	0.5690	0.5590	0.5590	0.5469	0.5498	0.5441	0.5469	0.5528	0.5528	0.5622 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.40)			12.1400	1.3258	16.0947		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			38.4990	0.1500	5.7749	75.6000	2910.5244 (28a)
Wl - Brick	88.0360	12.9650	75.0710	0.2500	18.7678	51.1800	3842.1338 (29a)
Wl - Render	2.5470	1.3100	1.2370	0.2500	0.3093	51.1800	63.3097 (29a)
Rf - Ins Joist	38.4990		38.4990	0.1000	3.8499	5.8200	224.0642 (30)
Total net area of external elements Aum(A, m2)			167.5760				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	47.3524	(33)
Party Wall			44.1740	0.0000	0.0000	54.0300	2386.7212 (32)
Ground Floor Stud			65.0160			5.8200	378.3931 (32c)
1st Floor Stud			103.2350			5.8200	600.8279 (32c)
Internal Floor			38.5000			18.0000	693.0000 (32d)
Internal Ceiling			38.5000			5.8200	224.0700 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11323.0443 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.0525 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3766 (36)
Total fabric heat loss							(33) + (36) = 56.7291 (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	37.7638	37.3003	37.3003	36.6475	36.6475	35.8563	36.0456	35.6726	35.8563	36.2406	36.2406	36.8595 (38)
Average = Sum(39)m / 12 =	94.4928	94.0294	94.0294	93.3766	93.3766	92.5854	92.7747	92.4017	92.5854	92.9697	92.9697	93.5886 (39)
HLP	1.2272	1.2212	1.2212	1.2127	1.2127	1.2024	1.2049	1.2000	1.2024	1.2074	1.2074	1.2154 (40)
HLP (average)												1.2112 (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												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)													Total = Sum(45)m =	1436.2293 (45)
Distribution loss (46)m = 0.15 x (45)m														
	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	14.6636	13.2191	14.5923	14.0727	14.5063	13.9974	14.4385	14.4825	14.0384	14.5567	14.1438	14.6495	(61)	
Total heat required for water heating calculated for each month	163.5699	143.4535	148.9825	131.2374	126.9286	111.0093	104.3342	117.6391	118.4272	136.2117	146.9397	158.8573	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	163.5699	143.4535	148.9825	131.2374	126.9286	111.0093	104.3342	117.6391	118.4272	136.2117	146.9397	158.8573	(64)	
Total per year (kWh/year) = Sum(64)m =													1607.5902 (64)	
Heat gains from water heating, kWh/month	53.1772	46.6077	48.3328	42.4754	41.0070	35.7558	33.5000	37.9202	38.2189	44.0895	47.6906	51.6115	(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	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.6833	44.1283	35.8876	27.1692	20.3093	17.1460	18.5268	24.0818	32.3226	41.0410	47.9009	51.0642	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	317.9949	321.2947	312.9793	295.2769	272.9307	251.9285	237.8977	234.5979	242.9133	260.6157	282.9619	303.9641	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	(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)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	(71)
Water heating gains (Table 5)	71.4748	69.3567	64.9635	58.9936	55.1169	49.6608	45.0268	50.9680	53.0817	59.2600	66.2369	69.3702	(72)
Total internal gains	542.0468	537.6735	516.7241	484.3335	451.2507	421.6291	404.3451	412.5416	431.2114	463.8105	499.9935	527.2923	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Southeast		7.3900	40.4699	0.5000	0.0000	0.7700	115.1430 (77)						
Northwest		4.7530	12.9236	0.5000	0.0000	0.7700	23.6489 (81)						
Solar gains	138.7919	219.9827	316.6327	437.9590	507.7863	553.4406	522.0745	466.2737	383.5243	265.1892	171.8028	116.7015	(83)
Total gains	680.8387	757.6562	833.3568	922.2925	959.0370	975.0696	926.4197	878.8152	814.7357	728.9998	671.7963	643.9938	(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	33.2860	33.4501	33.4501	33.6839	33.6839	33.9718	33.9025	34.0393	33.9718	33.8313	33.8313	33.6076	
alpha	3.2191	3.2300	3.2300	3.2456	3.2456	3.2648	3.2602	3.2693	3.2648	3.2554	3.2554	3.2405	
util living area	0.9556	0.9371	0.8956	0.8070	0.6619	0.4519	0.3057	0.3301	0.5898	0.8291	0.9285	0.9613	(86)
MIT	19.4911	19.6905	20.0553	20.4804	20.8004	20.9603	20.9921	20.9900	20.8993	20.5201	19.9585	19.4558	(87)
Th 2	19.8983	19.9031	19.9031	19.9099	19.9099	19.9181	19.9161	19.9200	19.9181	19.9141	19.9141	19.9077	(88)
util rest of house	0.9469	0.9250	0.8750	0.7695	0.5981	0.3626	0.2010	0.2216	0.5012	0.7869	0.9123	0.9535	(89)
MIT 2	18.5632	18.7603	19.1110	19.5098	19.7825	19.9017	19.9147	19.9180	19.8673	19.5591	19.0330	18.5363	(90)
Living area fraction													fLA = Living area / (4) = 0.2410 (91)
MIT	18.7869	18.9845	19.3386	19.7438	20.0278	20.1569	20.1744	20.1764	20.1161	19.7908	19.2561	18.7579	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.6369	18.8345	19.1886	19.5938	19.8778	20.0069	20.0244	20.0264	19.9661	19.6408	19.1061	18.6079	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9340	0.9102	0.8591	0.7573	0.5960	0.3702	0.2117	0.2325	0.5054	0.7745	0.8973	0.9415	(94)
Useful gains	635.8707	689.6477	715.9124	698.4063	571.6249	361.0168	196.0885	204.3498	411.7908	564.6275	602.7939	606.3266	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1279.1368	1244.4313	1108.4757	905.1724	642.2267	370.9784	197.0886	205.7196	441.2667	747.5476	1032.5288	1264.1859	(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	478.5900	372.8146	292.0672	148.8716	52.5277	0.0000	0.0000	0.0000	0.0000	136.0926	309.4091	489.4473	(98)
Space heating													2279.8200 (98)
Space heating per m ²													(98) / (4) = 29.6081 (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

	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													2519.1382 (211)
Space heating requirement	478.5900	372.8146	292.0672	148.8716	52.5277	0.0000	0.0000	0.0000	0.0000	136.0926	309.4091	489.4473	(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)	528.8287	411.9498	322.7261	164.4990	58.0417	0.0000	0.0000	0.0000	0.0000	150.3785	341.8885	540.8258	(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	163.5699	143.4535	148.9825	131.2374	126.9286	111.0093	104.3342	117.6391	118.4272	136.2117	146.9397	158.8573	(64)
Efficiency of water heater (217)m	89.6628	89.5875	89.3932	88.9720	88.2130	87.3000	87.3000	87.3000	87.3000	88.8705	89.4443	87.3000	(216)
Fuel for water heating, kWh/month	182.4277	160.1266	166.6598	147.5041	143.8887	127.1584	119.5123	134.7527	135.6554	153.2699	164.2806	177.1095	(219)
Water heating fuel used													1812.3458 (219)
Annual totals kWh/year													
Space heating fuel - main system													2519.1382 (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)													350.9694 (232)
Total delivered energy for all uses													4757.4533 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2519.1382	3.6300	91.4447 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1812.3458	3.6300	65.7882 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	350.9694	19.4400	68.2284 (250)
Additional standing charges			95.0000 (251)
Total energy cost			335.0413 (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	2519.1382	0.2160	544.1338 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1812.3458	0.2160	391.4667 (264)
Space and water heating			935.6005 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	350.9694	0.5190	182.1531 (268)
Total kg/year			1156.6786 (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	2519.1382	1.2200	3073.3486 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1812.3458	1.2200	2211.0619 (264)
Space and water heating			5284.4104 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	350.9694	3.0700	1077.4759 (268)
Primary energy kWh/year			6592.1364 (272)
Primary energy kWh/m2/year			85.6122 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
 Current environmental impact rating: B 86

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 25	-180 kg (15.6%)
U Solar photovoltaic panels	+ 10.9	-£ 355	-947 kg (96.9%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£25	2.34 kg/m ²	B 85	B 88
Solar photovoltaic panels	£355	12.30 kg/m ²	A 96	A 98
Total Savings	£380	14.63 kg/m²		

Potential energy efficiency rating: A 96
 Potential environmental impact rating: A 98

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, Thames Valley):

	Current	Potential	Saving
Electricity	£83	£93	-£10
Mains gas	£252	£218	£35
Space heating	£201	£201	£0
Water heating	£66	£41	£25
Lighting	£68	£68	£0
Generated (PV)	-£0	-£355	£355
Total cost of fuels	£335	-£44	£380
Total cost of uses	£335	-£45	£380
Delivered energy	62 kWh/m ²	26 kWh/m ²	35 kWh/m ²
Carbon dioxide emissions	1.2 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m ²	15 kg/m ²	0 kg/m ²	15 kg/m ²
Primary energy	86 kWh/m ²	0 kWh/m ²	86 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	38.5000 (1b)	2.4000 (2b)	92.4000 (1b) - (3b)
First floor	38.5000 (1c)	2.7600 (2c)	106.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 198.6600 (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) =	0.1510 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4015 (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) =	0.3714 (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	0.4735	0.4642	0.4550	0.4085	0.3993	0.3528	0.3528	0.3435	0.3714	0.3993	0.4178	0.4364 (22b)
	0.6121	0.6078	0.6035	0.5835	0.5797	0.5622	0.5622	0.5590	0.5690	0.5797	0.5873	0.5952 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.40)			12.1400	1.3258	16.0947		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			38.4990	0.1500	5.7749	75.6000	2910.5244 (28a)
Wl - Brick	88.0360	12.9650	75.0710	0.2500	18.7678	51.1800	3842.1338 (29a)
Wl - Render	2.5470	1.3100	1.2370	0.2500	0.3093	51.1800	63.3097 (29a)
Rf - Ins Joist	38.4990		38.4990	0.1000	3.8499	5.8200	224.0642 (30)
Total net area of external elements Aum(A, m2)			167.5760				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 47.3524		(33)
Party Wall			44.1740	0.0000	0.0000	54.0300	2386.7212 (32)
Ground Floor Stud			65.0160			5.8200	378.3931 (32c)
1st Floor Stud			103.2350			5.8200	600.8279 (32c)
Internal Floor			38.5000			18.0000	693.0000 (32d)
Internal Ceiling			38.5000			5.8200	224.0700 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11323.0443 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.0525 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3766 (36)
Total fabric heat loss							(33) + (36) = 56.7291 (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	40.1290	39.8436	39.5638	38.2498	38.0040	36.8595	36.8595	36.6475	37.3003	38.0040	38.5013	39.0213 (38)
Average = Sum(39)m / 12 =	96.8581	96.5727	96.2929	94.9789	94.7330	93.5886	93.5886	93.3766	94.0294	94.7330	95.2304	95.7504 (39)
												94.9777 (39)
HLP	1.2579	1.2542	1.2506	1.2335	1.2303	1.2154	1.2154	1.2127	1.2212	1.2303	1.2368	1.2435 (40)
HLP (average)												1.2335 (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												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1436.2293 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6636	13.2191	14.5923	14.0727	14.5063	13.9974	14.4385	14.4825	14.0384	14.5567	14.1438	14.6495	(61)
Total heat required for water heating calculated for each month	163.5699	143.4535	148.9825	131.2374	126.9286	111.0093	104.3342	117.6391	118.4272	136.2117	146.9397	158.8573	(62)
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.7000 (H2)	
Collector heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0050 (H3a)	
Collector effective heat loss coefficient												1.8063 (H3b)	
Collector performance ratio												2.5804 (H4)	
Annual solar radiation per m2												1079.5246 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												1813.6014 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.2628 (H8)	
Utilisation factor												0.5470 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												91.2825 (H14)	
Volume ratio Veff/V												0.8216 (H15)	
Solar storage volume factor												0.9607 (H16)	
Solar input	-24.3020	-40.5531	-69.0666	-92.5628	-114.3535	-112.4277	-110.9420	-96.9305	-75.9161	-51.8417	-28.8257	-838.0584	(H17)
Solar input (sum of months) = Sum(63)m =												-838.0584 (63)	
Output from w/h	139.2679	102.9004	79.9159	38.6746	12.5750	0.0000	0.0000	20.7086	42.5111	84.3700	118.1140	138.5207	(64)
Total per year (kWh/year) = Sum(64)m =												777.5581 (64)	
Heat gains from water heating, kWh/month	53.1772	46.6077	48.3328	42.4754	41.0070	35.7558	33.5000	37.9202	38.2189	44.0895	47.6906	51.6115	(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	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.6833	44.1283	35.8876	27.1692	20.3093	17.1460	18.5268	24.0818	32.3226	41.0410	47.9009	51.0642	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	317.9949	321.2947	312.9793	295.2769	272.9307	251.9285	237.8977	234.5979	242.9133	260.6157	282.9619	303.9641	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	(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)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	(71)
Water heating gains (Table 5)	71.4748	69.3567	64.9635	58.9936	55.1169	49.6608	45.0268	50.9680	53.0817	59.2600	66.2369	69.3702	(72)
Total internal gains	542.0468	537.6735	516.7241	484.3335	451.2507	421.6291	404.3451	412.5416	431.2114	463.8105	499.9935	527.2923	(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							
Southeast	7.3900	36.7938	0.5000	0.0000	0.7700	104.6840 (77)							
Northwest	4.7530	11.2829	0.5000	0.0000	0.7700	20.6467 (81)							
Solar gains	125.3307	220.3425	319.6983	426.6547	505.7578	514.3591	490.7956	429.9070	356.4428	248.4370	151.3662	106.4488	(83)
Total gains	667.3775	758.0160	836.4224	910.9882	957.0085	935.9882	895.1407	842.4485	787.6543	712.2475	651.3596	633.7412	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)												21.0000 (85)	
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.4732	32.5691	32.6638	33.1157	33.2016	33.6076	33.6076	33.6839	33.4501	33.2016	33.0282	32.8489	
alpha	3.1649	3.1713	3.1776	3.2077	3.2134	3.2405	3.2405	3.2456	3.2300	3.2134	3.2019	3.1899	
util living area	0.9634	0.9447	0.9108	0.8423	0.7302	0.5761	0.4392	0.4801	0.6850	0.8689	0.9447	0.9683	(86)
MIT	19.2875	19.5248	19.8831	20.3245	20.6775	20.8938	20.9669	20.9554	20.8062	20.3516	19.7484	19.2451	(87)
Th 2	19.8740	19.8769	19.8798	19.8933	19.8958	19.9077	19.9077	19.9099	19.9031	19.8958	19.8907	19.8853	(88)
util rest of house	0.9563	0.9342	0.8936	0.8115	0.6778	0.4964	0.3385	0.3777	0.6103	0.8364	0.9324	0.9621	(89)
MIT 2	18.3448	18.5785	18.9274	19.3541	19.6697	19.8506	19.8960	19.8929	19.7878	19.3916	18.8116	18.3117	(90)
Living area fraction												f _{LA} = Living area / (4) =	
MIT	18.5720	18.8066	19.1577	19.5880	19.9126	20.1021	20.1541	20.1490	20.0333	19.6230	19.0374	18.5367	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4220	18.6566	19.0077	19.4380	19.7626	19.9521	20.0041	19.9990	19.8833	19.4730	18.8874	18.3867	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9444	0.9198	0.8773	0.7969	0.6708	0.4999	0.3477	0.3865	0.6088	0.8216	0.9182	0.9511	(94)
Useful gains	630.2426	697.2401	733.8285	725.9603	641.9866	467.8583	311.2802	325.6215	479.5059	585.1540	598.0904	602.7689	(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													
	1367.8337	1328.5104	1204.4069	1000.8905	763.7979	500.8920	318.5874	336.0649	543.7988	840.5647	1122.5178	1358.3831	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	548.7678	424.2136	350.1103	197.9498	90.6276	0.0000	0.0000	0.0000	0.0000	190.0255	377.5878	562.1770	(98)
Space heating												2741.4594	(98)
Space heating per m2												(98) / (4) =	35.6034 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3029.2369 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	548.7678	424.2136	350.1103	197.9498	90.6276	0.0000	0.0000	0.0000	0.0000	190.0255	377.5878	562.1770	(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)	606.3733	468.7444	386.8622	218.7290	100.1410	0.0000	0.0000	0.0000	0.0000	209.9729	417.2240	621.1900	(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	139.2679	102.9004	79.9159	38.6746	12.5750	0.0000	0.0000	20.7086	42.5111	84.3700	118.1140	138.5207	(64)
Efficiency of water heater	89.8335	89.8570	89.8877	89.9610	90.0976	87.3000	87.3000	87.3000	87.3000	89.4914	89.7164	89.8489	(217)
Fuel for water heating, kWh/month	155.0289	114.5157	88.9064	42.9904	13.9571	0.0000	0.0000	23.7212	48.6954	94.2772	131.6526	154.1706	(219)
												867.9155	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													3029.2369 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													350.9694 (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													2645.8824 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3029.2369	3.4800	105.4174	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	867.9155	3.4800	30.2035	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	350.9694	13.1900	46.2929	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit		-1727.2394	13.1900	-227.8229 (252)
Total energy cost			90.5784	(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] =	0.3118 (257)
SAP value		95.6500
SAP rating (Section 12)		96 (258)
SAP band		A

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

Energy Emission factor Emissions

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3029.2369	0.2160	654.3152 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	867.9155	0.2160	187.4698 (264)
Space and water heating			841.7849 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	350.9694	0.5190	182.1531 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			192.3758 (272)
CO2 emissions per m2			2.5000 (273)
EI value			97.8870
EI rating			98 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	38.5000 (1b)	2.4000 (2b)	92.4000 (1b) - (3b)
First floor	38.5000 (1c)	2.7600 (2c)	106.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 198.6600 (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) =	0.1510 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.4015 (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) =	0.3714 (21)							
Wind speed	Jan 4.2000	Feb 4.0000	Mar 4.0000	Apr 3.7000	May 3.7000	Jun 3.3000	Jul 3.4000	Aug 3.2000	Sep 3.3000	Oct 3.5000	Nov 3.5000	Dec 3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3900	0.3714	0.3714	0.3435	0.3435	0.3064	0.3157	0.2971	0.3064	0.3250	0.3250	0.3528 (22b)
	0.5760	0.5690	0.5690	0.5590	0.5590	0.5469	0.5498	0.5441	0.5469	0.5528	0.5528	0.5622 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.40)			12.1400	1.3258	16.0947		(27)
Solid Door			2.1300	1.2000	2.5560		(26)
Flr - Ground			38.4990	0.1500	5.7749	75.6000	2910.5244 (28a)
Wl - Brick	88.0360	12.9650	75.0710	0.2500	18.7678	51.1800	3842.1338 (29a)
Wl - Render	2.5470	1.3100	1.2370	0.2500	0.3093	51.1800	63.3097 (29a)
Rf - Ins Joist	38.4990		38.4990	0.1000	3.8499	5.8200	224.0642 (30)
Total net area of external elements Aum(A, m2)			167.5760				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	47.3524	(33)
Party Wall			44.1740	0.0000	0.0000	54.0300	2386.7212 (32)
Ground Floor Stud			65.0160			5.8200	378.3931 (32c)
1st Floor Stud			103.2350			5.8200	600.8279 (32c)
Internal Floor			38.5000			18.0000	693.0000 (32d)
Internal Ceiling			38.5000			5.8200	224.0700 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11323.0443 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.0525 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3766 (36)
Total fabric heat loss							(33) + (36) = 56.7291 (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	37.7638	37.3003	37.3003	36.6475	36.6475	35.8563	36.0456	35.6726	35.8563	36.2406	36.2406	36.8595 (38)
Average = Sum(39)m / 12 =	94.4928	94.0294	94.0294	93.3766	93.3766	92.5854	92.7747	92.4017	92.5854	92.9697	92.9697	93.5886 (39)
												93.2650 (39)
HLP	1.2272	1.2212	1.2212	1.2127	1.2127	1.2024	1.2049	1.2000	1.2024	1.2074	1.2074	1.2154 (40)
HLP (average)												1.2112 (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												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m =	1436.2293 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6636	13.2191	14.5923	14.0727	14.5063	13.9974	14.4385	14.4825	14.0384	14.5567	14.1438	14.6495	(61)
Total heat required for water heating calculated for each month	163.5699	143.4535	148.9825	131.2374	126.9286	111.0093	104.3342	117.6391	118.4272	136.2117	146.9397	158.8573	(62)
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.7000 (H2)	
Collector heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0050 (H3a)	
Collector effective heat loss coefficient												1.8063 (H3b)	
Collector performance ratio												2.5804 (H4)	
Annual solar radiation per m2												1140.0998 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												1915.3676 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.3336 (H8)	
Utilisation factor												0.5276 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												91.2825 (H14)	
Volume ratio Veff/V												0.8216 (H15)	
Solar storage volume factor												0.9607 (H16)	
Solar input	-26.2730	-39.4883	-66.5033	-91.9279	-110.7121	-116.5197	-113.7218	-101.5543	-79.2635	-53.9215	-31.9356	-853.5884	(H17)
Solar input												-21.7674 (63)	
Solar input (sum of months) = Sum(63)m =												-853.5884 (63)	
Output from w/h	137.2969	103.9652	82.4792	39.3094	16.2164	0.0000	0.0000	16.0848	39.1637	82.2902	115.0041	137.0899	(64)
Total per year (kWh/year) = Sum(64)m =												768.8999 (64)	
Heat gains from water heating, kWh/month	53.1772	46.6077	48.3328	42.4754	41.0070	35.7558	33.5000	37.9202	38.2189	44.0895	47.6906	51.6115	(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	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.6833	44.1283	35.8876	27.1692	20.3093	17.1460	18.5268	24.0818	32.3226	41.0410	47.9009	51.0642	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	317.9949	321.2947	312.9793	295.2769	272.9307	251.9285	237.8977	234.5979	242.9133	260.6157	282.9619	303.9641	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	(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)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	(71)
Water heating gains (Table 5)	71.4748	69.3567	64.9635	58.9936	55.1169	49.6608	45.0268	50.9680	53.0817	59.2600	66.2369	69.3702	(72)
Total internal gains	542.0468	537.6735	516.7241	484.3335	451.2507	421.6291	404.3451	412.5416	431.2114	463.8105	499.9935	527.2923	(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				
Southeast		7.3900	40.4699	0.5000		0.0000	0.7700	115.1430	(77)				
Northwest		4.7530	12.9236	0.5000		0.0000	0.7700	23.6489	(81)				
Solar gains	138.7919	219.9827	316.6327	437.9590	507.7863	553.4406	522.0745	466.2737	383.5243	265.1892	171.8028	116.7015	(83)
Total gains	680.8387	757.6562	833.3568	922.2925	959.0370	975.0696	926.4197	878.8152	814.7357	728.9998	671.7963	643.9938	(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	33.2860	33.4501	33.4501	33.6839	33.6839	33.9718	33.9025	34.0393	33.9718	33.8313	33.8313	33.6076	
alpha	3.2191	3.2300	3.2300	3.2456	3.2456	3.2648	3.2602	3.2693	3.2648	3.2554	3.2554	3.2405	
util living area	0.9556	0.9371	0.8956	0.8070	0.6619	0.4519	0.3057	0.3301	0.5898	0.8291	0.9285	0.9613	(86)
MIT	19.4911	19.6905	20.0553	20.4804	20.8004	20.9603	20.9921	20.9900	20.8993	20.5201	19.9585	19.4558	(87)
Th 2	19.8983	19.9031	19.9031	19.9099	19.9099	19.9181	19.9161	19.9200	19.9181	19.9141	19.9141	19.9077	(88)
util rest of house	0.9469	0.9250	0.8750	0.7695	0.5981	0.3626	0.2010	0.2216	0.5012	0.7869	0.9123	0.9535	(89)
MIT 2	18.5632	18.7603	19.1110	19.5098	19.7825	19.9017	19.9147	19.9180	19.8673	19.5591	19.0330	18.5363	(90)
Living area fraction												fLA = Living area / (4) =	
MIT	18.7869	18.9845	19.3386	19.7438	20.0278	20.1569	20.1744	20.1764	20.1161	19.7908	19.2561	18.7579	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6369	18.8345	19.1886	19.5938	19.8778	20.0069	20.0244	20.0264	19.9661	19.6408	19.1061	18.6079	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9340	0.9102	0.8591	0.7573	0.5960	0.3702	0.2117	0.2325	0.5054	0.7745	0.8973	0.9415	(94)
Useful gains	635.8707	689.6477	715.9124	698.4063	571.6249	361.0168	196.0885	204.3498	411.7908	564.6275	602.7939	606.3266	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1279.1368	1244.4313	1108.4757	905.1724	642.2267	370.9784	197.0886	205.7196	441.2667	747.5476	1032.5288	1264.1859	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	478.5900	372.8146	292.0672	148.8716	52.5277	0.0000	0.0000	0.0000	0.0000	136.0926	309.4091	489.4473	(98)
Space heating												2279.8200	(98)
Space heating per m2												29.6081	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2519.1382	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	478.5900	372.8146	292.0672	148.8716	52.5277	0.0000	0.0000	0.0000	0.0000	136.0926	309.4091	489.4473	(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)	528.8287	411.9498	322.7261	164.4990	58.0417	0.0000	0.0000	0.0000	0.0000	150.3785	341.8885	540.8258	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	137.2969	103.9652	82.4792	39.3094	16.2164	0.0000	0.0000	16.0848	39.1637	82.2902	115.0041	137.0899	(64)	
Efficiency of water heater	89.7665	89.7824	89.7753	89.8123	89.7242	87.3000	87.3000	87.3000	87.3000	89.2670	89.6099	89.7799	(217)	
Fuel for water heating, kWh/month	152.9489	115.7969	91.8729	43.7684	18.0736	0.0000	0.0000	18.4248	44.8610	92.1843	128.3386	152.6955	(219)	
Water heating fuel used												858.9650	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2519.1382	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													350.9694	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596				-1824.1596	(233)
Total delivered energy for all uses													2029.9128	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2519.1382	3.6300	91.4447	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	858.9650	3.6300	31.1804	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Pump for solar water heating	50.0000	19.4400	9.7200	(249)
Energy for lighting	350.9694	19.4400	68.2284	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	19.4400	-354.6166	(252)
Total energy cost			-44.4630	(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	2519.1382	0.2160	544.1338	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	858.9650	0.2160	185.5364	(264)
Space and water heating			729.6703	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	350.9694	0.5190	182.1531	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)
Total kg/year			29.9595	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2519.1382	1.2200	3073.3486 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	858.9650	1.2200	1047.9373 (264)
Space and water heating			4121.2858 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	350.9694	3.0700	1077.4759 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-17.6583 (272)
Primary energy kWh/m2/year			-0.2293 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	147.1 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.21 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	275.96 (P1)
Transmission heat loss coefficient	56.73 (37)
Summer heat loss coefficient	332.69 (P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
South East	0.850	0.90	1.000	0.765 (P8)
North 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
South East	7.3900	119.9223	0.5000	0.0000	0.7650	338.9815
North West	4.7530	98.8453	0.5000	0.0000	0.7650	179.7029

total: 518.6844

Solar gains	Jun 550	Jul 519	Aug 463	(P4)
Internal gains	419	401	410	
Total summer gains	968	920	873	(P5)

Summer gain/loss ratio	2.91	2.77	2.62	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 147.1)	0.97	0.97	0.97	
Threshold temperature	19.88	21.64	21.39	(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	036 - PRJ012701		Issued on Date	23/09/2022	
Assessment Reference	036 S	Prop Type Ref	2D		
Property	Plot 36				
SAP Rating	83 B	DER	18.12	TER	18.76
Environmental	86 B	% DER<TER	3.39		
CO₂ Emissions (t/year)	1.16	DFEE	47.21	TFEE	52.66
General Requirements Compliance	Pass	% DFEE<TFEE	10.36		
Assessor Details	Chris Nicholls, , Tel: ,		Assessor ID	W933-0001	
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)	18.76	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.12	kgCO ₂ /m ²	Pass
	-0.64 (-3.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.66	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	47.21	kWh/m ² /yr	
	-5.5 (-10.4%)	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	0.15 (max. 0.25)	0.15 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing South East

7.39 m², No overhang

Windows facing North West

4.75 m², No overhang

Air change rate

4.21 ach

Blinds/curtains

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

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.01 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K