

PREDICTED ENERGY ASSESSMENT

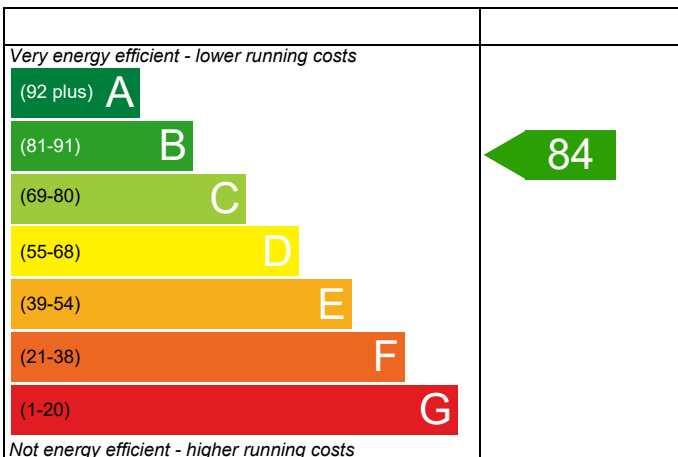
Lancing Phase 2,
BN15

Dwelling type: House, End-Terrace
Date of assessment: 01/02/2023
Produced by: Michael Juckes
Total floor area: 94.29 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

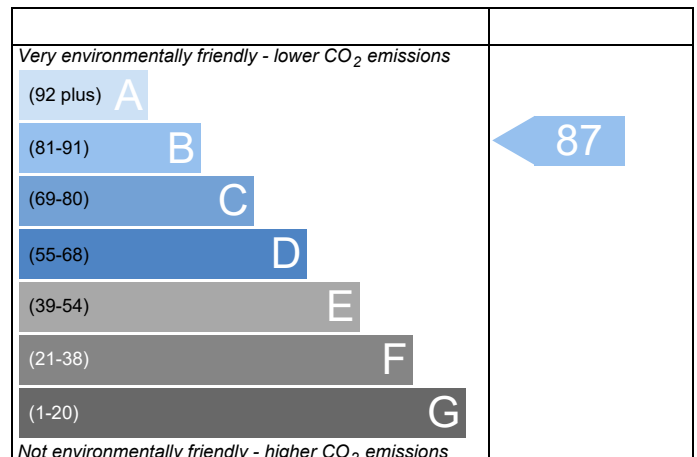


England

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	628 - PRJ012992			Issued on Date	01/02/2023
Assessment Reference	628	Prop Type Ref	Clover		
Property	Lancing Phase 2, BN15				
SAP Rating	84 B	DER	16.35	TER	17.33
Environmental	87 B	% DER<TER	5.67		
CO ₂ Emissions (t/year)	1.29	DFEE	42.96	TFEE	49.50
General Requirements Compliance	Pass	% DFEE<TFEE	13.22		
Assessor Details	Chris Nicholls, , Tel: ,			Assessor ID	T850-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 94 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.33 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.35 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.35 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

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

Data from database

Ideal LOGIC COMBI ESP1 30

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0%

OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England): Slight OK

Based on:

Overshading:

Average

Windows facing North:

5.52 m², No overhang

Windows facing South:

6.78 m², No overhang

Air change rate:

4.61 ach

Blinds/curtains:

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

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.10 W/m²K

Door U-value 1.09 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1450 (1b)	2.3850 (2b)	112.4408 (1b) - (3b)
First floor	47.1450 (1c)	2.6860 (2c)	126.6315 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.2900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 239.0723 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				2 * 10 =	20.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.0837 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3337 (18)							
Number of sides sheltered					1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3086 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3935	0.3858	0.3781	0.3395	0.3318	0.2932	0.2932	0.2855	0.3086	0.3318	0.3472	0.3626 (22b)
Effective ac	0.5774	0.5744	0.5715	0.5576	0.5550	0.5430	0.5430	0.5408	0.5476	0.5550	0.5603	0.5658 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			12.2900	1.3258	16.3068		(27)
Flr - Ground			47.1450	0.1586	7.4760	75.6000	3564.1620 (28a)
Brick	86.4060	11.5330	74.8730	0.2500	18.7183	51.1900	3832.7489 (29a)
Render	12.8030	2.8800	9.9230	0.2500	2.4808	51.1900	507.9584 (29a)
Rf - Ins Joist	47.1450		47.1450	0.1000	4.7145	7.4000	348.8730 (30)
Total net area of external elements Aum(A, m2)			193.5060				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.0071		(33)
Party Wall			43.6110	0.0000	0.0000	7.4000	322.7214 (32)
Stud			91.2883			7.4000	675.5331 (32c)
Stud			101.1548			7.4000	748.5452 (32c)
Internal Floor			47.1450			7.4000	348.8730 (32d)
Internal Ceiling			47.1450			7.4000	348.8730 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10698.2880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							113.4615 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1559 (36)
Total fabric heat loss						(33) + (36) =	60.1631 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.5552	45.3180	45.0855	43.9935	43.7892	42.8381	42.8381	42.6619	43.2044	43.7892	44.2025	44.6346 (38)
Average = Sum(39)m / 12 =	105.7182	105.4810	105.2485	104.1565	103.9522	103.0011	103.0011	102.8250	103.3675	103.9522	104.3655	104.7977 (39)
HLP	1.1212	1.1187	1.1162	1.1046	1.1025	1.0924	1.0924	1.0905	1.0963	1.1025	1.1069	1.1114 (40)
HLP (average)												1.1046 (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												2.6800 (42)
Average daily hot water use (litres/day)												97.8502 (43)
Daily hot water use	107.6352	103.7212	99.8072	95.8932	91.9792	88.0652	88.0652	91.9792	95.8932	99.8072	103.7212	107.6352 (44)
Energy conte	159.6199	139.6046	144.0595	125.5945	120.5109	103.9918	96.3637	110.5787	111.8994	130.4079	142.3505	154.5834 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1539.5649 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.9430	20.9407	21.6089	18.8392	18.0766	15.5988	14.4546	16.5868	16.7849	19.5612	21.3526	23.1875	23.1875	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6958	13.2599	14.6483	14.1196	14.5494	14.0330	14.4715	14.5220	14.0802	14.6074	14.1854	14.6807	14.6807	(61)
Total heat required for water heating calculated for each month	174.3157	152.8645	158.7077	139.7141	135.0604	118.0248	110.8352	125.1008	125.9796	145.0153	156.5358	169.2641	169.2641	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
													Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h	174.3157	152.8645	158.7077	139.7141	135.0604	118.0248	110.8352	125.1008	125.9796	145.0153	156.5358	169.2641	169.2641	(64)
													Total per year (kWh/year) = Sum(64)m =	1711.4180 (64)
Heat gains from water heating, kWh/month	56.7476	49.7335	51.5618	45.2901	43.7073	38.0855	35.6588	40.3979	40.7266	47.0125	50.8779	55.0691	55.0691	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.8241	21.1604	17.2088	13.0281	9.7387	8.2218	8.8840	11.5477	15.4993	19.6799	22.9694	24.4863	24.4863	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.7528	249.3133	242.8608	229.1244	211.7846	195.4876	184.6002	182.0397	188.4921	202.2286	219.5684	235.8654	235.8654	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	(71)
Water heating gains (Table 5)	76.2736	74.0082	69.3035	62.9029	58.7463	52.8966	47.9285	54.2983	56.5647	63.1888	70.6637	74.0177	74.0177	(72)
Total internal gains	413.0506	410.6820	395.5733	371.2556	346.4697	322.8061	307.6128	314.0858	326.7563	351.2975	379.4016	400.5694	400.5694	(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							
North		5.5160	10.6334	0.7300	0.7200	0.7700	21.3641 (74)						
South		6.7760	46.7521	0.7300	0.7200	0.7700	115.3886 (78)						
Solar gains	136.7527	229.8046	310.0994	383.5056	433.6281	433.5453	416.6204	377.9247	334.8766	252.4294	163.1302	117.5165	(83)
Total gains	549.8033	640.4866	705.6727	754.7612	780.0978	756.3514	724.2331	692.0105	661.6328	603.7269	542.5318	518.0859	(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	28.1101	28.1733	28.2355	28.5315	28.5876	28.8516	28.8516	28.9010	28.7493	28.5876	28.4744	28.3570	28.3570	
alpha	2.8740	2.8782	2.8824	2.9021	2.9058	2.9234	2.9234	2.9267	2.9166	2.9058	2.8983	2.8905	2.8905	
util living area	0.9756	0.9615	0.9387	0.8952	0.8176	0.6919	0.5550	0.5919	0.7719	0.9095	0.9630	0.9793	0.9793 (86)	
MIT	18.8256	19.0835	19.4696	19.9602	20.4144	20.7573	20.9085	20.8868	20.6388	20.0530	19.3502	18.7758	18.7758 (87)	
Th 2	19.9836	19.9856	19.9876	19.9970	19.9988	20.0071	20.0071	20.0086	20.0039	19.9988	19.9952	19.9915	19.9915 (88)	
util rest of house	0.9716	0.9552	0.9282	0.8757	0.7801	0.6228	0.4527	0.4923	0.7139	0.8887	0.9558	0.9758	0.9758 (89)	
MIT 2	17.9953	18.2513	18.6328	19.1168	19.5465	19.8537	19.9658	19.9543	19.7578	19.2147	18.5249	17.9517	17.9517 (90)	
Living area fraction													fLA = Living area / (4) =	0.2008 (91)
MIT	18.1620	18.4184	18.8008	19.2861	19.7208	20.0352	20.1551	20.1415	19.9347	19.3830	18.6906	18.1171	18.1171 (92)	
Temperature adjustment													-0.1500	
adjusted MIT	18.0120	18.2684	18.6508	19.1361	19.5708	19.8852	20.0051	19.9915	19.7847	19.2330	18.5406	17.9671	17.9671 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9608	0.9409	0.9103	0.8552	0.7614	0.6133	0.4524	0.4904	0.6990	0.8686	0.9419	0.9662	0.9662 (94)	
Useful gains	528.2606	602.6523	642.3910	645.4659	593.9876	463.8947	327.6710	339.3449	462.4744	524.4238	510.9851	500.5595	500.5595 (95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	4.2000 (96)	
Heat loss rate W	1449.6069	1410.1134	1278.8527	1066.1593	818.1840	544.3772	350.7270	369.2941	587.6145	897.4247	1194.0023	1442.7612	1442.7612 (97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)	
Space heating kWh	685.4817	542.6139	473.5275	302.8992	166.8022	0.0000	0.0000	0.0000	0.0000	277.5126	491.7724	700.9980	700.9980 (98)	
Space heating													3641.6074 (98)	
Space heating per m2													(98) / (4) =	38.6214 (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													4023.8756 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	685.4817	542.6139	473.5275	302.8992	166.8022	0.0000	0.0000	0.0000	0.0000	277.5126	491.7724	700.9980	(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)	757.4383	599.5733	523.2348	334.6952	184.3118	0.0000	0.0000	0.0000	0.0000	306.6438	543.3949	774.5834	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	174.3157	152.8645	158.7077	139.7141	135.0604	118.0248	110.8352	125.1008	125.9796	145.0153	156.5358	169.2641	(64)
Efficiency of water heater (217)m	89.8324	89.7767	89.6749	89.4648	89.0397	87.3000	87.3000	87.3000	87.3000	89.3756	89.7061	87.3000	(216)
Fuel for water heating, kWh/month	194.0455	170.2719	176.9813	156.1665	151.6856	135.1945	126.9590	143.2998	144.3065	162.2538	174.4986	188.3655	(219)
Water heating fuel used													1924.0285 (219)
Annual totals kWh/year													
Space heating fuel - main system													4023.8756 (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)													420.7414 (232)
Total delivered energy for all uses													6443.6455 (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	4023.8756	0.2160	869.1571	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1924.0285	0.2160	415.5902	(264)
Space and water heating			1284.7473	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	420.7414	0.5190	218.3648	(268)
Total CO2, kg/year			1542.0371	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.3500	(273)

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

DER			16.3500	ZC1
Total Floor Area		TFA	94.2900	
Assumed number of occupants		N	2.6800	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.5075	ZC2
CO2 emissions from cooking, equation (L16)			1.9442	ZC3
Total CO2 emissions			33.8017	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			33.8017	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	47.1450 (1b)	2.3850 (2b)	112.4408 (1b) - (3b)
First floor	47.1450 (1c)	2.6860 (2c)	126.6315 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.2900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 239.0723 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				30.0000 / (5) =	0.1255 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate					0.3755 (18)							
Number of sides sheltered				1	1 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3473 (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	0.4428	0.4342	0.4255	0.3821	0.3734	0.3300	0.3300	0.3213	0.3473	0.3734	0.3907	0.4081 (22b)
Effective ac	0.5981	0.5942	0.5905	0.5730	0.5697	0.5544	0.5544	0.5516	0.5603	0.5697	0.5763	0.5833 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			12.2900	1.3258	16.3068		(27)					
Flr - Ground			47.1450	0.1300	6.1289		(28a)					
Brick	86.4060	11.5330	74.8730	0.1800	13.4771		(29a)					
Render	12.8030	2.8800	9.9230	0.1800	1.7861		(29a)					
Rf - Ins Joist	47.1450		47.1450	0.1300	6.1289		(30)					
Total net area of external elements Aum(A, m2)			193.5060				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		45.9478 (33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5067 (36)					
Total fabric heat loss							(33) + (36) = 55.4545 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.1827	Feb 46.8823	Mar 46.5878	Apr 45.2049	May 44.9461	Jun 43.7416	Jul 43.7416	Aug 43.5185	Sep 44.2056	Oct 44.9461	Nov 45.4696	Dec 46.0168 (38)
Heat transfer coeff	102.6372	102.3368	102.0423	100.6593	100.4006	99.1961	99.1961	98.9730	99.6600	100.4006	100.9240	101.4713 (39)
Average = Sum(39)m / 12 =												100.6581 (39)
HLP	Jan 1.0885	Feb 1.0853	Mar 1.0822	Apr 1.0676	May 1.0648	Jun 1.0520	Jul 1.0520	Aug 1.0497	Sep 1.0570	Oct 1.0648	Nov 1.0704	Dec 1.0762 (40)
HLP (average)												1.0675 (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												2.6800 (42)
Average daily hot water use (litres/day)												97.8502 (43)
Daily hot water use	107.6352	103.7212	99.8072	95.8932	91.9792	88.0652	88.0652	91.9792	95.8932	99.8072	103.7212	107.6352 (44)
Energy conte	159.6199	139.6046	144.0595	125.5945	120.5109	103.9918	96.3637	110.5787	111.8994	130.4079	142.3505	154.5834 (45)
Energy content (annual)												Total = Sum(45)m = 1539.5649 (45)
Distribution loss (46)m = 0.15 x (45)m	23.9430	20.9407	21.6089	18.8392	18.0766	15.5988	14.4546	16.5868	16.7849	19.5612	21.3526	23.1875 (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

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3877.9767 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	699.4734	551.7462	474.5063	287.4250	136.1088	0.0000	0.0000	0.0000	0.0000	263.5697	495.5756	713.6251	(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)	748.9009	590.7347	508.0367	307.7356	145.7268	0.0000	0.0000	0.0000	0.0000	282.1946	530.5949	764.0526	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	210.5788	185.6320	194.9201	172.8843	167.3825	147.4212	141.2407	157.4503	159.1892	181.2686	191.6655	205.5423	(64)
Efficiency of water heater (217)m	87.8434	87.6254	87.2062	86.3221	84.5358	80.3000	80.3000	80.3000	80.3000	85.9926	87.3364	80.3000	(216)
Fuel for water heating, kWh/month	239.7208	211.8472	223.5164	200.2781	198.0020	183.5880	175.8913	196.0776	198.2431	210.7957	219.4567	233.7649	(219)
Water heating fuel used													2491.1818 (219)
Annual totals kWh/year													
Space heating fuel - main system													3877.9767 (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)													423.3678 (232)
Total delivered energy for all uses													6867.5263 (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	3877.9767	0.2160	837.6430 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2491.1818	0.2160	538.0953 (264)
Space and water heating			1375.7382 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.3678	0.5190	219.7279 (268)
Total CO2, kg/m2/year			1634.3911 (272)
Emissions per m2 for space and water heating			14.5905 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3303 (272b)
Emissions per m2 for pumps and fans			0.4128 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5905 * 1.00) + 2.3303 + 0.4128, rounded to 2 d.p.			17.3300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1450 (1b)	2.3850 (2b)	112.4408 (1b) - (3b)
First floor	47.1450 (1c)	2.6860 (2c)	126.6315 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.2900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 239.0723 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1255 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3755 (18)							
Number of sides sheltered					1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3473 (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	0.4428	0.4342	0.4255	0.3821	0.3734	0.3300	0.3300	0.3213	0.3473	0.3734	0.3907	0.4081 (22b)
Effective ac	0.5981	0.5942	0.5905	0.5730	0.5697	0.5544	0.5544	0.5516	0.5603	0.5697	0.5763	0.5833 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			12.2900	1.3258	16.3068		(27)
Flr - Ground			47.1450	0.1586	7.4760	75.6000	3564.1620 (28a)
Brick	86.4060	11.5330	74.8730	0.2500	18.7183	51.1900	3832.7489 (29a)
Render	12.8030	2.8800	9.9230	0.2500	2.4808	51.1900	507.9584 (29a)
Rf - Ins Joist	47.1450		47.1450	0.1000	4.7145	7.4000	348.8730 (30)
Total net area of external elements Aum(A, m2)			193.5060				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.0071		(33)
Party Wall			43.6110	0.0000	0.0000	7.4000	322.7214 (32)
Stud			91.2883			7.4000	675.5331 (32c)
Stud			101.1548			7.4000	748.5452 (32c)
Internal Floor			47.1450			7.4000	348.8730 (32d)
Internal Ceiling			47.1450			7.4000	348.8730 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10698.2880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							113.4615 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1559 (36)
Total fabric heat loss						(33) + (36) =	60.1631 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	47.1827	46.8823	46.5878	45.2049	44.9461	43.7416	43.7416	43.5185	44.2056	44.9461	45.4696	46.0168 (38)
Average = Sum(39)m / 12 =	107.3457	107.0453	106.7509	105.3679	105.1092	103.9046	103.9046	103.6816	104.3686	105.1092	105.6326	106.1799 (39)
HLP	1.1385	1.1353	1.1322	1.1175	1.1147	1.1020	1.1020	1.0996	1.1069	1.1147	1.1203	1.1261 (40)
HLP (average)												1.1175 (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												2.6800 (42)
Average daily hot water use (litres/day)												97.8502 (43)
Daily hot water use	107.6352	103.7212	99.8072	95.8932	91.9792	88.0652	88.0652	91.9792	95.8932	99.8072	103.7212	107.6352 (44)
Energy conte	159.6199	139.6046	144.0595	125.5945	120.5109	103.9918	96.3637	110.5787	111.8994	130.4079	142.3505	154.5834 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1539.5649 (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
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
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
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
Heat gains from water heating, kWh/month	33.9192	29.6660	30.6126	26.6888	25.6086	22.0983	20.4773	23.4980	23.7786	27.7117	30.2495	32.8490	65)						

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

Metabolic gains (Table 5), Watts													
(66)m	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.8241	21.1604	17.2088	13.0281	9.7387	8.2218	8.8840	11.5477	15.4993	19.6799	22.9694	24.4863	67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.7528	249.3133	242.8608	229.1244	211.7846	195.4876	184.6002	182.0397	188.4921	202.2286	219.5684	235.8654	68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	70)
Losses e.g. evaporation (negative values) (Table 5)	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	71)
Water heating gains (Table 5)	45.5904	44.1458	41.1460	37.0678	34.4201	30.6920	27.5232	31.5833	33.0259	37.2469	42.0132	44.1518	72)
Total internal gains	379.3674	377.8196	364.4158	342.4205	319.1435	297.6015	284.2075	288.3708	300.2174	322.3555	347.7511	367.7036	73)

6. Solar gains

[Jan]													
		Area	Solar flux					FF		Access		Gains	
		m2	Table 6a					Specific data		factor		W	
			W/m2					or Table 6b		Table 6d			
								Specific data					
								or Table 6c					
North		5.5160	10.6334			0.7300		0.7200		0.7700		21.3641	74)
South		6.7760	46.7521			0.7300		0.7200		0.7700		115.3886	78)
Solar gains	136.7527	229.8046	310.0994	383.5056	433.6281	433.5453	416.6204	377.9247	334.8766	252.4294	163.1302	117.5165	83)
Total gains	516.1201	607.6242	674.5152	725.9261	752.7716	731.1469	700.8279	666.2955	635.0940	574.7850	510.8812	485.2201	84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	27.6839	27.7616	27.8381	28.2035	28.2730	28.6007	28.6007	28.6622	28.4736	28.2730	28.1328	27.9879	
alpha	2.8456	2.8508	2.8559	2.8802	2.8849	2.9067	2.9067	2.9108	2.8982	2.8849	2.8755	2.8659	
util living area	0.9792	0.9662	0.9451	0.9042	0.8303	0.7078	0.5716	0.6104	0.7882	0.9191	0.9681	0.9824	86)
MIT	18.7353	18.9988	19.3951	19.9043	20.3751	20.7374	20.8993	20.8749	20.6097	19.9986	19.2769	18.6912	87)
Th 2	19.9695	19.9721	19.9747	19.9866	19.9888	19.9992	19.9992	20.0012	19.9952	19.9888	19.9843	19.9796	88)
util rest of house	0.9757	0.9606	0.9354	0.8858	0.7941	0.6391	0.4673	0.5094	0.7316	0.8999	0.9618	0.9795	89)
MIT 2	17.8962	18.1586	18.5512	19.0564	19.5040	19.8323	19.9535	19.9407	19.7274	19.1563	18.4453	17.8596	90)
Living area fraction									fLA = Living area / (4) =			0.2008	91)
MIT	18.0647	18.3273	18.7206	19.2266	19.6789	20.0140	20.1434	20.1283	19.9046	19.3254	18.6123	18.0265	92)
Temperature adjustment												0.0000	
adjusted MIT	18.0647	18.3273	18.7206	19.2266	19.6789	20.0140	20.1434	20.1283	19.9046	19.3254	18.6123	18.0265	93)

8. Space heating requirement

Utilisation	0.9668	0.9485	0.9203	0.8690	0.7812	0.6402	0.4836	0.5235	0.7257	0.8842	0.9504	0.9716	94)
Useful gains	498.9830	576.3559	620.7726	630.8415	588.0936	468.0698	338.9029	348.7950	460.8727	508.2108	485.5318	471.4230	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	1477.5789	1437.3294	1304.5615	1088.0962	838.6563	562.5426	368.1765	386.5520	605.8154	917.1225	1216.0736	1468.0976	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	728.0754	578.5742	508.7389	329.2234	186.4186	0.0000	0.0000	0.0000	0.0000	304.2303	525.9901	741.5259	98)
Space heating												3902.7768	98)
Space heating per m2												41.3912	99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
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	976.7037	768.8944	787.9801	0.0000	0.0000	0.0000	0.0000	100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7364	0.8064	0.7843	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	719.2914	620.0030	618.0338	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	957.1206	919.5749	881.2439	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	171.2370	222.8815	195.8283	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												589.9469 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	42.8093	55.7204	48.9571	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												147.4867 (107)
Space cooling per m2												1.5642 (108)
Energy for space heating												41.3912 (99)
Energy for space cooling												1.5642 (108)
Total												42.9554 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1450 (1b)	2.3850 (2b)	112.4408 (1b) - (3b)
First floor	47.1450 (1c)	2.6860 (2c)	126.6315 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.2900		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 239.0723 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				30.0000 / (5) =	0.1255 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate					0.3755 (18)							
Number of sides sheltered				1	1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3473 (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	0.4428	0.4342	0.4255	0.3821	0.3734	0.3300	0.3300	0.3213	0.3473	0.3734	0.3907	0.4081 (22b)
Effective ac	0.5981	0.5942	0.5905	0.5730	0.5697	0.5544	0.5544	0.5516	0.5603	0.5697	0.5763	0.5833 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			12.2900	1.3258	16.3068		(27)					
Flr - Ground			47.1450	0.1300	6.1289		(28a)					
Brick	86.4060	11.5330	74.8730	0.1800	13.4771		(29a)					
Render	12.8030	2.8800	9.9230	0.1800	1.7861		(29a)					
Rf - Ins Joist	47.1450		47.1450	0.1300	6.1289		(30)					
Total net area of external elements Aum(A, m2)			193.5060				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26) ... (30) + (32) =		45.9478 (33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5067 (36)					
Total fabric heat loss							(33) + (36) = 55.4545 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.1827	Feb 46.8823	Mar 46.5878	Apr 45.2049	May 44.9461	Jun 43.7416	Jul 43.7416	Aug 43.5185	Sep 44.2056	Oct 44.9461	Nov 45.4696	Dec 46.0168 (38)
Heat transfer coeff	102.6372	102.3368	102.0423	100.6593	100.4006	99.1961	99.1961	98.9730	99.6600	100.4006	100.9240	101.4713 (39)
Average = Sum(39)m / 12 =												100.6581 (39)
HLP	Jan 1.0885	Feb 1.0853	Mar 1.0822	Apr 1.0676	May 1.0648	Jun 1.0520	Jul 1.0520	Aug 1.0497	Sep 1.0570	Oct 1.0648	Nov 1.0704	Dec 1.0762 (40)
HLP (average)												1.0675 (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												2.6800 (42)
Average daily hot water use (litres/day)												97.8502 (43)
Daily hot water use	107.6352	103.7212	99.8072	95.8932	91.9792	88.0652	88.0652	91.9792	95.8932	99.8072	103.7212	107.6352 (44)
Energy conte	159.6199	139.6046	144.0595	125.5945	120.5109	103.9918	96.3637	110.5787	111.8994	130.4079	142.3505	154.5834 (45)
Energy content (annual)												Total = Sum(45)m = 1539.5649 (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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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	33.9192	29.6660	30.6126	26.6888	25.6086	22.0983	20.4773	23.4980	23.7786	27.7117	30.2495	32.8490	32.8490	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	134.0005	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9728	21.2925	17.3162	13.1095	9.7995	8.2731	8.9394	11.6198	15.5961	19.8028	23.1128	24.6391	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.7528	249.3133	242.8608	229.1244	211.7846	195.4876	184.6002	182.0397	188.4921	202.2286	219.5684	235.8654	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	36.4000	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	(71)
Water heating gains (Table 5)	45.5904	44.1458	41.1460	37.0678	34.4201	30.6920	27.5232	31.5833	33.0259	37.2469	42.0132	44.1518	(72)
Total internal gains	379.5161	377.9517	364.5232	342.5018	319.2043	297.6529	284.2630	288.4429	300.3142	322.4784	347.8944	367.8565	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	5.5160	10.6334	0.6300	0.7000	0.7700	17.9254 (74)							
South	6.7760	46.7521	0.6300	0.7000	0.7700	96.8158 (78)							
Solar gains	114.7411	192.8155	260.1862	321.7770	363.8318	363.7624	349.5616	317.0943	280.9752	211.7987	136.8729	98.6012	(83)
Total gains	494.2572	570.7672	624.7093	664.2788	683.0361	661.4152	633.8246	605.5372	581.2894	534.2770	484.7674	466.4576	(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)	63.7967	63.9840	64.1686	65.0503	65.2179	66.0098	66.0098	66.1586	65.7025	65.2179	64.8796	64.5297	21.0000 (85)
alpha	5.2531	5.2656	5.2779	5.3367	5.3479	5.4007	5.4007	5.4106	5.3802	5.3479	5.3253	5.3020	
util living area	0.9990	0.9975	0.9939	0.9817	0.9415	0.8260	0.6571	0.7044	0.9048	0.9862	0.9977	0.9992	(86)
MIT	19.7708	19.9132	20.1340	20.4278	20.7060	20.9102	20.9798	20.9708	20.8361	20.4767	20.0710	19.7495	(87)
Th 2	20.0102	20.0128	20.0154	20.0274	20.0297	20.0402	20.0402	20.0422	20.0361	20.0297	20.0251	20.0203	(88)
util rest of house	0.9986	0.9967	0.9916	0.9740	0.9142	0.7471	0.5295	0.5802	0.8506	0.9790	0.9968	0.9990	(89)
MIT 2	18.8832	19.0274	19.2492	19.5490	19.8153	19.9941	20.0345	20.0329	19.9377	19.6010	19.1951	18.8701	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	19.0614	19.2052	19.4269	19.7255	19.9941	20.1780	20.2242	20.2212	20.1181	19.7768	19.3709	19.0466	(92)
Temperature adjustment	0.0000												
adjusted MIT	19.0614	19.2052	19.4269	19.7255	19.9941	20.1780	20.2242	20.2212	20.1181	19.7768	19.3709	19.0466	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9957	0.9897	0.9709	0.9130	0.7600	0.5554	0.6052	0.8561	0.9765	0.9959	0.9986	(94)
Useful gains	493.3297	568.3177	618.2852	644.9583	623.5888	502.6539	352.0340	366.5001	497.6698	521.7057	482.7639	465.8141	(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	1515.0644	1463.9505	1319.0881	1089.6860	832.7357	553.3174	359.5108	378.1945	599.7623	921.3597	1238.4325	1506.5072	(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	760.1706	601.8652	521.3974	320.2039	155.6053	0.0000	0.0000	0.0000	0.0000	297.3426	544.0814	774.2757	(98)
Space heating	3974.9421 (98)												
Space heating per m ²	42.1566 (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	932.4431	734.0509	752.1949	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8161	0.8952	0.8736	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	760.9684	657.1099	657.1423	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	875.6844	841.3332	810.3238	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	82.5955	137.0621	113.9670	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling	333.6246 (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	20.6489	34.2655	28.4917	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											83.4061 (107)	
Space cooling per m2											0.8846 (108)	
Energy for space heating											42.1566 (99)	
Energy for space cooling											0.8846 (108)	
Total											43.0411 (109)	
Target Fabric Energy Efficiency (TFEE)											49.5 (109)	

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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 CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1450 (1b)	2.3850 (2b)	112.4408 (1b) - (3b)
First floor	47.1450 (1c)	2.6860 (2c)	126.6315 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.2900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 239.0723 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.0837 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3337 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3086 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.7000	5.2000	4.9000	4.5000	4.6000	4.2000	4.3000	4.2000	4.5000	4.9000	4.9000	5.2000 (22)
Wind factor	1.4250	1.3000	1.2250	1.1250	1.1500	1.0500	1.0750	1.0500	1.1250	1.2250	1.2250	1.3000 (22a)
Adj infilt rate												
Effective ac	0.4398	0.4012	0.3781	0.3472	0.3549	0.3241	0.3318	0.3241	0.3472	0.3781	0.3781	0.4012 (22b)
	0.5967	0.5805	0.5715	0.5603	0.5630	0.5525	0.5550	0.5525	0.5603	0.5715	0.5715	0.5805 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			12.2900	1.3258	16.3068		(27)
Flr - Ground			47.1450	0.1586	7.4760	75.6000	3564.1620 (28a)
Brick	86.4060	11.5330	74.8730	0.2500	18.7183	51.1900	3832.7489 (29a)
Render	12.8030	2.8800	9.9230	0.2500	2.4808	51.1900	507.9584 (29a)
Rf - Ins Joist	47.1450		47.1450	0.1000	4.7145	7.4000	348.8730 (30)
Total net area of external elements Aum(A, m2)			193.5060				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.0071		(33)
Party Wall			43.6110	0.0000	0.0000	7.4000	322.7214 (32)
Stud			91.2883			7.4000	675.5331 (32c)
Stud			101.1548			7.4000	748.5452 (32c)
Internal Floor			47.1450			7.4000	348.8730 (32d)
Internal Ceiling			47.1450			7.4000	348.8730 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10698.2880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							113.4615 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1559 (36)
Total fabric heat loss							(33) + (36) = 60.1631 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	47.0770	45.7971	45.0855	44.2025	44.4162	43.5895	43.7892	43.5895	44.2025	45.0855	45.0855	45.7971 (38)
Average = Sum(39)m / 12 =	107.2400	105.9601	105.2485	104.3655	104.5792	103.7526	103.9522	103.7526	104.3655	105.2485	105.2485	105.9601 (39)
												104.9728 (39)
HLP	1.1373	1.1238	1.1162	1.1069	1.1091	1.1004	1.1025	1.1004	1.1069	1.1162	1.1162	1.1238 (40)
HLP (average)												1.1133 (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												2.6800 (42)
Average daily hot water use (litres/day)												97.8502 (43)
Daily hot water use	107.6352	103.7212	99.8072	95.8932	91.9792	88.0652	88.0652	91.9792	95.8932	99.8072	103.7212	107.6352 (44)
Energy conte	159.6199	139.6046	144.0595	125.5945	120.5109	103.9918	96.3637	110.5787	111.8994	130.4079	142.3505	154.5834 (45)

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Energy content (annual)													Total = Sum(45)m =	1539.5649 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.9430	20.9407	21.6089	18.8392	18.0766	15.5988	14.4546	16.5868	16.7849	19.5612	21.3526	23.1875	23.1875	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6958	13.2599	14.6483	14.1196	14.5494	14.0330	14.4715	14.5220	14.0802	14.6074	14.1854	14.6807	14.6807	(61)
Total heat required for water heating calculated for each month	174.3157	152.8645	158.7077	139.7141	135.0604	118.0248	110.8352	125.1008	125.9796	145.0153	156.5358	169.2641	169.2641	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	174.3157	152.8645	158.7077	139.7141	135.0604	118.0248	110.8352	125.1008	125.9796	145.0153	156.5358	169.2641	169.2641	(64)
Total per year (kWh/year) = Sum(64)m =													1711.4180 (64)	
RHI water heating demand													1711 (64)	
Heat gains from water heating, kWh/month	56.7476	49.7335	51.5618	45.2901	43.7073	38.0855	35.6588	40.3979	40.7266	47.0125	50.8779	55.0691	55.0691	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.5603	52.9009	43.0219	32.5704	24.3467	20.5545	22.2099	28.8693	38.7483	49.1998	57.4235	61.2157	61.2157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.2877	372.1094	362.4789	341.9767	316.0964	291.7725	275.5227	271.7010	281.3315	301.8337	327.7140	352.0379	352.0379	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	(71)
Water heating gains (Table 5)	76.2736	74.0082	69.3035	62.9029	58.7463	52.8966	47.9285	54.2983	56.5647	63.1888	70.6637	74.0177	74.0177	(72)
Total internal gains	614.4818	609.3787	585.1646	547.8102	509.5496	475.5839	456.0213	465.2288	487.0047	524.5826	566.1614	597.6314	597.6314	(73)

6. Solar gains

[Jan]		Area	Solar flux	Specific data	FF	Access	Gains							
		m2	Table 6a	g	Specific data	factor	W							
			W/m2	or Table 6b	or Table 6c	Table 6d								
North		5.5160	13.4530	0.7300	0.7200	0.7700	27.0292 (74)							
South		6.7760	56.4170	0.7300	0.7200	0.7700	139.2426 (78)							
Solar gains	166.2718	241.8716	331.2842	431.1319	474.8129	516.1714	484.6118	441.2493	380.6105	285.8485	197.6818	140.4882	140.4882	(83)
Total gains	780.7536	851.2503	916.4488	978.9421	984.3626	991.7552	940.6331	906.4781	867.6152	810.4311	763.8432	738.1196	738.1196	(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	27.7112	28.0459	28.2355	28.4744	28.4162	28.6426	28.5876	28.6426	28.4744	28.2355	28.2355	28.0459	28.0459	
alpha	2.8474	2.8697	2.8824	2.8983	2.8944	2.9095	2.9058	2.9095	2.8983	2.8824	2.8824	2.8697	2.8697	
util living area	0.9357	0.9196	0.8841	0.8137	0.6995	0.5347	0.4089	0.3931	0.6063	0.7972	0.8988	0.9411	0.9411	(86)
MIT	19.3414	19.4993	19.8434	20.2825	20.6628	20.8911	20.9630	20.9694	20.8405	20.4663	19.9039	19.3434	19.3434	(87)
Th 2	19.9705	19.9815	19.9876	19.9952	19.9934	20.0005	19.9988	20.0005	19.9952	19.9876	19.9876	19.9815	19.9815	(88)
util rest of house	0.9254	0.9073	0.8660	0.7836	0.6480	0.4579	0.3123	0.2914	0.5291	0.7559	0.8802	0.9315	0.9315	(89)
MIT 2	18.4921	18.6529	18.9904	19.4119	19.7531	19.9408	19.9853	19.9905	19.9031	19.5834	19.0551	18.5031	18.5031	(90)
Living area fraction	18.6626	18.8229	19.1616	19.5867	19.9357	20.1316	20.1816	20.1871	20.0913	19.7607	19.2255	18.6718	18.6718	(92)
Temperature adjustment												-0.1500	-0.1500	
adjusted MIT	18.5126	18.6729	19.0116	19.4367	19.7857	19.9816	20.0316	20.0371	19.9413	19.6107	19.0755	18.5218	18.5218	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	708.1893	755.5731	774.4727	748.4057	626.3657	452.6404	296.8611	267.6928	455.1410	598.1547	656.5683	674.5311	674.5311	(95)
Ext temp.	5.4000	5.6000	7.1000	9.5000	12.6000	15.3000	17.1000	17.4000	15.1000	12.0000	8.6000	5.6000	5.6000	(96)
Heat loss rate W	1406.1968	1385.2022	1253.6835	1037.0477	751.4802	485.7305	304.7479	273.6012	505.2651	801.0120	1102.5362	1369.1944	1369.1944	(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	1.0000	(97a)
Space heating kWh	519.3175	423.1107	356.5328	207.8223	93.0852	0.0000	0.0000	0.0000	0.0000	150.9258	321.0969	516.8294	516.8294	(98)
Space heating													2588.7207 (98)	
RHI space heating demand													2589 (98)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1450 (1b)	2.3850 (2b)	112.4408 (1b) - (3b)
First floor	47.1450 (1c)	2.6860 (2c)	126.6315 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.2900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 239.0723 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				2 * 10 =	20.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.0837 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3337 (18)							
Number of sides sheltered					1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3086 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3935	0.3858	0.3781	0.3395	0.3318	0.2932	0.2932	0.2855	0.3086	0.3318	0.3472	0.3626 (22b)
Effective ac	0.5774	0.5744	0.5715	0.5576	0.5550	0.5430	0.5430	0.5408	0.5476	0.5550	0.5603	0.5658 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			12.2900	1.3258	16.3068		(27)
Flr - Ground			47.1450	0.1586	7.4760	75.6000	3564.1620 (28a)
Brick	86.4060	11.5330	74.8730	0.2500	18.7183	51.1900	3832.7489 (29a)
Render	12.8030	2.8800	9.9230	0.2500	2.4808	51.1900	507.9584 (29a)
Rf - Ins Joist	47.1450		47.1450	0.1000	4.7145	7.4000	348.8730 (30)
Total net area of external elements Aum(A, m2)			193.5060				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.0071		(33)
Party Wall			43.6110	0.0000	0.0000	7.4000	322.7214 (32)
Stud			91.2883			7.4000	675.5331 (32c)
Stud			101.1548			7.4000	748.5452 (32c)
Internal Floor			47.1450			7.4000	348.8730 (32d)
Internal Ceiling			47.1450			7.4000	348.8730 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10698.2880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							113.4615 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1559 (36)
Total fabric heat loss							(33) + (36) = 60.1631 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.5552	45.3180	45.0855	43.9935	43.7892	42.8381	42.8381	42.6619	43.2044	43.7892	44.2025	44.6346 (38)
Average = Sum(39)m / 12 =	105.7182	105.4810	105.2485	104.1565	103.9522	103.0011	103.0011	102.8250	103.3675	103.9522	104.3655	104.7977 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1212	1.1187	1.1162	1.1046	1.1025	1.0924	1.0924	1.0905	1.0963	1.1025	1.1069	1.1114 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6800 (42)											
Average daily hot water use (litres/day)	97.8502 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.6352	103.7212	99.8072	95.8932	91.9792	88.0652	88.0652	91.9792	95.8932	99.8072	103.7212	107.6352 (44)
	159.6199	139.6046	144.0595	125.5945	120.5109	103.9918	96.3637	110.5787	111.8994	130.4079	142.3505	154.5834 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1539.5649 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.9430	20.9407	21.6089	18.8392	18.0766	15.5988	14.4546	16.5868	16.7849	19.5612	21.3526	23.1875	23.1875	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6958	13.2599	14.6483	14.1196	14.5494	14.0330	14.4715	14.5220	14.0802	14.6074	14.1854	14.6807	14.6807	(61)
Total heat required for water heating calculated for each month	174.3157	152.8645	158.7077	139.7141	135.0604	118.0248	110.8352	125.1008	125.9796	145.0153	156.5358	169.2641	169.2641	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
	Solar input (sum of months) = Sum(63)m =												0.0000 (63)	
Output from w/h	174.3157	152.8645	158.7077	139.7141	135.0604	118.0248	110.8352	125.1008	125.9796	145.0153	156.5358	169.2641	169.2641	(64)
	Total per year (kWh/year) = Sum(64)m =												1711.4180 (64)	
Heat gains from water heating, kWh/month	56.7476	49.7335	51.5618	45.2901	43.7073	38.0855	35.6588	40.3979	40.7266	47.0125	50.8779	55.0691	55.0691	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.5603	52.9009	43.0219	32.5704	24.3467	20.5545	22.2099	28.8693	38.7483	49.1998	57.4235	61.2157	61.2157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.2877	372.1094	362.4789	341.9767	316.0964	291.7725	275.5227	271.7010	281.3315	301.8337	327.7140	352.0379	352.0379	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	(71)
Water heating gains (Table 5)	76.2736	74.0082	69.3035	62.9029	58.7463	52.8966	47.9285	54.2983	56.5647	63.1888	70.6637	74.0177	74.0177	(72)
Total internal gains	614.4818	609.3787	585.1646	547.8102	509.5496	475.5839	456.0213	465.2288	487.0047	524.5826	566.1614	597.6314	597.6314	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
North		5.5160	10.6334	0.7300	0.7200	0.7700	21.3641 (74)							
South		6.7760	46.7521	0.7300	0.7200	0.7700	115.3886 (78)							
Solar gains	136.7527	229.8046	310.0994	383.5056	433.6281	433.5453	416.6204	377.9247	334.8766	252.4294	163.1302	117.5165	117.5165	(83)
Total gains	751.2345	839.1834	895.2640	931.3158	943.1777	909.1292	872.6417	843.1535	821.8813	777.0120	729.2916	715.1479	715.1479	(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	28.1101	28.1733	28.2355	28.5315	28.5876	28.8516	28.8516	28.9010	28.7493	28.5876	28.4744	28.3570	28.3570	
alpha	2.8740	2.8782	2.8824	2.9021	2.9058	2.9234	2.9234	2.9267	2.9166	2.9058	2.8983	2.8905	2.8905	
util living area	0.9488	0.9289	0.8983	0.8434	0.7531	0.6164	0.4795	0.5104	0.6898	0.8514	0.9273	0.9547	0.9547	(86)
MIT	19.1376	19.3733	19.7208	20.1554	20.5435	20.8236	20.9380	20.9238	20.7390	20.2532	19.6235	19.0871	19.0871	(87)
Th 2	19.9836	19.9856	19.9876	19.9970	19.9988	20.0071	20.0071	20.0086	20.0039	19.9988	19.9952	19.9915	19.9915	(88)
util rest of house	0.9410	0.9182	0.8926	0.8178	0.7099	0.5463	0.3849	0.4168	0.6260	0.8220	0.9146	0.9478	0.9478	(89)
MIT 2	18.3009	18.5325	18.8723	19.2958	19.6551	19.8993	19.9802	19.9736	19.8330	19.3967	18.7887	18.2573	18.2573	(90)
Living area fraction	fLA = Living area / (4) =												0.2008 (91)	
MIT	18.4689	18.7013	19.0427	19.4684	19.8335	20.0849	20.1725	20.1644	20.0149	19.5686	18.9563	18.4239	18.4239	(92)
Temperature adjustment													-0.1500	
adjusted MIT	18.3189	18.5513	18.8927	19.3184	19.6835	19.9349	20.0225	20.0144	19.8649	19.4186	18.8063	18.2739	18.2739	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9246	0.8994	0.8620	0.7975	0.6946	0.5407	0.3865	0.4174	0.6161	0.8019	0.8957	0.9324	0.9324	(94)
Useful gains	694.6043	754.7730	771.6913	742.7491	655.1720	491.5824	337.2356	351.9582	506.3313	623.0704	653.2187	666.7947	666.7947	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	4.2000	(96)
Heat loss rate W	1482.0550	1439.9529	1304.3093	1085.1442	829.8993	549.5008	352.5185	371.6468	595.9057	916.7170	1221.7342	1474.9158	1474.9158	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	585.8633	460.4408	396.2678	246.5245	129.9971	0.0000	0.0000	0.0000	0.0000	218.4731	409.3312	601.2421	601.2421	(98)
Space heating													3048.1399 (98)	
Space heating per m ²													(98) / (4) =	32.3273 (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													3368.1104 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	585.8633	460.4408	396.2678	246.5245	129.9971	0.0000	0.0000	0.0000	0.0000	218.4731	409.3312	601.2421	(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)	647.3628	508.7744	437.8650	272.4028	143.6432	0.0000	0.0000	0.0000	0.0000	241.4067	452.2996	664.3559	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	174.3157	152.8645	158.7077	139.7141	135.0604	118.0248	110.8352	125.1008	125.9796	145.0153	156.5358	169.2641	(64)
Efficiency of water heater (217)m	89.7457	89.6807	89.5612	89.3157	88.8407	87.3000	87.3000	87.3000	87.3000	89.1956	89.5915	87.3000	(216)
Fuel for water heating, kWh/month	194.2330	170.4543	177.2059	156.4272	152.0254	135.1945	126.9590	143.2998	144.3065	162.5812	174.7216	188.5382	(219)
Water heating fuel used													1925.9468 (219)
Annual totals kWh/year													
Space heating fuel - main system													3368.1104 (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)													420.7414 (232)
Total delivered energy for all uses													5789.7986 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3368.1104	3.4800	117.2102 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1925.9468	3.4800	67.0229 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	420.7414	13.1900	55.4958 (250)
Additional standing charges			120.0000 (251)
Total energy cost			369.6215 (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] =	1.1145 (257)
SAP value		84.4525
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3368.1104	0.2160	727.5119 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1925.9468	0.2160	416.0045 (264)
Space and water heating			1143.5164 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	420.7414	0.5190	218.3648 (268)
Total kg/year			1400.8061 (272)
CO2 emissions per m2			14.8600 (273)
EI value			86.5239
EI rating			87 (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	$3.48 / 0.8874 = 3.921$, stars = 4
Water heating environmental impact	$0.216 / 0.8874 = 0.2434$, 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	47.1450 (1b)	2.3850 (2b)	112.4408 (1b) - (3b)
First floor	47.1450 (1c)	2.6860 (2c)	126.6315 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.2900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 239.0723 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				2 * 10 =	20.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.0837 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3337 (18)							
Number of sides sheltered					1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3086 (21)							
Wind speed	Jan 5.7000	Feb 5.2000	Mar 4.9000	Apr 4.5000	May 4.6000	Jun 4.2000	Jul 4.3000	Aug 4.2000	Sep 4.5000	Oct 4.9000	Nov 4.9000	Dec 5.2000 (22)
Wind factor	1.4250	1.3000	1.2250	1.1250	1.1500	1.0500	1.0750	1.0500	1.1250	1.2250	1.2250	1.3000 (22a)
Adj inflt rate												
Effective ac	0.4398	0.4012	0.3781	0.3472	0.3549	0.3241	0.3318	0.3241	0.3472	0.3781	0.3781	0.4012 (22b)
	0.5967	0.5805	0.5715	0.5603	0.5630	0.5525	0.5550	0.5525	0.5603	0.5715	0.5715	0.5805 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			12.2900	1.3258	16.3068		(27)
Flr - Ground			47.1450	0.1586	7.4760	75.6000	3564.1620 (28a)
Brick	86.4060	11.5330	74.8730	0.2500	18.7183	51.1900	3832.7489 (29a)
Render	12.8030	2.8800	9.9230	0.2500	2.4808	51.1900	507.9584 (29a)
Rf - Ins Joist	47.1450		47.1450	0.1000	4.7145	7.4000	348.8730 (30)
Total net area of external elements Aum(A, m2)			193.5060				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.0071		(33)
Party Wall			43.6110	0.0000	0.0000	7.4000	322.7214 (32)
Stud			91.2883			7.4000	675.5331 (32c)
Stud			101.1548			7.4000	748.5452 (32c)
Internal Floor			47.1450			7.4000	348.8730 (32d)
Internal Ceiling			47.1450			7.4000	348.8730 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10698.2880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							113.4615 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1559 (36)
Total fabric heat loss						(33) + (36) =	60.1631 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	47.0770	45.7971	45.0855	44.2025	44.4162	43.5895	43.7892	43.5895	44.2025	45.0855	45.0855	45.7971 (38)
Average = Sum(39)m / 12 =	107.2400	105.9601	105.2485	104.3655	104.5792	103.7526	103.9522	103.7526	104.3655	105.2485	105.2485	105.9601 (39)
												104.9728 (39)
HLP	1.1373	1.1238	1.1162	1.1069	1.1091	1.1004	1.1025	1.1004	1.1069	1.1162	1.1162	1.1238 (40)
HLP (average)												1.1133 (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												2.6800 (42)
Average daily hot water use (litres/day)												97.8502 (43)
Daily hot water use	107.6352	103.7212	99.8072	95.8932	91.9792	88.0652	88.0652	91.9792	95.8932	99.8072	103.7212	107.6352 (44)
Energy conte	159.6199	139.6046	144.0595	125.5945	120.5109	103.9918	96.3637	110.5787	111.8994	130.4079	142.3505	154.5834 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m =	1539.5649 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.9430	20.9407	21.6089	18.8392	18.0766	15.5988	14.4546	16.5868	16.7849	19.5612	21.3526	23.1875	23.1875 (46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6958	13.2599	14.6483	14.1196	14.5494	14.0330	14.4715	14.5220	14.0802	14.6074	14.1854	14.6807	14.6807 (61)
Total heat required for water heating calculated for each month	174.3157	152.8645	158.7077	139.7141	135.0604	118.0248	110.8352	125.1008	125.9796	145.0153	156.5358	169.2641	169.2641 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
												Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h	174.3157	152.8645	158.7077	139.7141	135.0604	118.0248	110.8352	125.1008	125.9796	145.0153	156.5358	169.2641	169.2641 (64)
												Total per year (kWh/year) = Sum(64)m =	1711.4180 (64)
Heat gains from water heating, kWh/month	56.7476	49.7335	51.5618	45.2901	43.7073	38.0855	35.6588	40.3979	40.7266	47.0125	50.8779	55.0691	55.0691 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.5603	52.9009	43.0219	32.5704	24.3467	20.5545	22.2099	28.8693	38.7483	49.1998	57.4235	61.2157	61.2157 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.2877	372.1094	362.4789	341.9767	316.0964	291.7725	275.5227	271.7010	281.3315	301.8337	327.7140	352.0379	352.0379 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004 (71)
Water heating gains (Table 5)	76.2736	74.0082	69.3035	62.9029	58.7463	52.8966	47.9285	54.2983	56.5647	63.1888	70.6637	74.0177	74.0177 (72)
Total internal gains	614.4818	609.3787	585.1646	547.8102	509.5496	475.5839	456.0213	465.2288	487.0047	524.5826	566.1614	597.6314	597.6314 (73)

6. Solar gains

[Jan]		Area	Solar flux	Specific data	FF	Access	Gains						
		m ²	Table 6a	g	Specific data	factor	W						
			W/m ²	or Table 6b	or Table 6c	Table 6d							
North		5.5160	13.4530	0.7300	0.7200	0.7700	27.0292 (74)						
South		6.7760	56.4170	0.7300	0.7200	0.7700	139.2426 (78)						
Solar gains	166.2718	241.8716	331.2842	431.1319	474.8129	516.1714	484.6118	441.2493	380.6105	285.8485	197.6818	140.4882	140.4882 (83)
Total gains	780.7536	851.2503	916.4488	978.9421	984.3626	991.7552	940.6331	906.4781	867.6152	810.4311	763.8432	738.1196	738.1196 (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	27.7112	28.0459	28.2355	28.4744	28.4162	28.6426	28.5876	28.6426	28.4744	28.2355	28.2355	28.0459	28.0459
alpha	2.8474	2.8697	2.8824	2.8983	2.8944	2.9095	2.9058	2.9095	2.8983	2.8824	2.8824	2.8697	2.8697
util living area	0.9357	0.9196	0.8841	0.8137	0.6995	0.5347	0.4089	0.3931	0.6063	0.7972	0.8988	0.9411	0.9411 (86)
MIT	19.3414	19.4993	19.8434	20.2825	20.6628	20.8911	20.9630	20.9694	20.8405	20.4663	19.9039	19.3434	19.3434 (87)
Th 2	19.9705	19.9815	19.9876	19.9952	19.9934	20.0005	19.9988	20.0005	19.9952	19.9876	19.9876	19.9815	19.9815 (88)
util rest of house	0.9254	0.9073	0.8660	0.7836	0.6480	0.4579	0.3123	0.2914	0.5291	0.7559	0.8802	0.9315	0.9315 (89)
MIT 2	18.4921	18.6529	18.9904	19.4119	19.7531	19.9408	19.9853	19.9905	19.9031	19.5834	19.0551	18.5031	18.5031 (90)
Living area fraction												fLA = Living area / (4) =	0.2008 (91)
MIT	18.6626	18.8229	19.1616	19.5867	19.9357	20.1316	20.1816	20.1871	20.0913	19.7607	19.2255	18.6718	18.6718 (92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5126	18.6729	19.0116	19.4367	19.7857	19.9816	20.0316	20.0371	19.9413	19.6107	19.0755	18.5218	18.5218 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9071	0.8876	0.8451	0.7645	0.6363	0.4564	0.3156	0.2953	0.5246	0.7381	0.8596	0.9139	0.9139 (94)
Useful gains	708.1893	755.5731	774.4727	748.4057	626.3657	452.6404	296.8611	267.6928	455.1410	598.1547	656.5683	674.5311	674.5311 (95)
Ext temp.	5.4000	5.6000	7.1000	9.5000	12.6000	15.3000	17.1000	17.4000	15.1000	12.0000	8.6000	5.6000	5.6000 (96)
Heat loss rate W	1406.1968	1385.2022	1253.6835	1037.0477	751.4802	485.7305	304.7479	273.6012	505.2651	801.0120	1102.5362	1369.1944	1369.1944 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	519.3175	423.1107	356.5328	207.8223	93.0852	0.0000	0.0000	0.0000	0.0000	150.9258	321.0969	516.8294	516.8294 (98)
Space heating												2588.7207 (98)	
Space heating per m2												(98) / (4) =	27.4549 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2860.4649 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	519.3175	423.1107	356.5328	207.8223	93.0852	0.0000	0.0000	0.0000	0.0000	150.9258	321.0969	516.8294	(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)	573.8315	467.5257	393.9589	229.6379	102.8566	0.0000	0.0000	0.0000	0.0000	166.7689	354.8032	571.0823	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	174.3157	152.8645	158.7077	139.7141	135.0604	118.0248	110.8352	125.1008	125.9796	145.0153	156.5358	169.2641	(64)
Efficiency of water heater (217)m	89.6739	89.6281	89.4896	89.1858	88.5779	87.3000	87.3000	87.3000	87.3000	88.9032	89.4257	87.3000	(216)
Fuel for water heating, kWh/month	194.3884	170.5543	177.3477	156.6552	152.4764	135.1945	126.9590	143.2998	144.3065	163.1161	175.0456	188.7235	(219)
Water heating fuel used													1928.0670 (219)
Annual totals kWh/year													
Space heating fuel - main system													2860.4649 (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)													420.7414 (232)
Total delivered energy for all uses													5284.2732 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2860.4649	4.2600	121.8558 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1928.0670	4.2600	82.1357 (247)
Pumps and fans for heating	75.0000	22.5500	16.9125 (249)
Energy for lighting	420.7414	22.5500	94.8772 (250)
Additional standing charges			96.0000 (251)
Total energy cost			411.7811 (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	2860.4649	0.2160	617.8604 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1928.0670	0.2160	416.4625 (264)
Space and water heating			1034.3229 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	420.7414	0.5190	218.3648 (268)
Total kg/year			1291.6126 (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	2860.4649	1.2200	3489.7671 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1928.0670	1.2200	2352.2417 (264)
Space and water heating			5842.0088 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	420.7414	3.0700	1291.6760 (268)
Primary energy kWh/year			7363.9348 (272)
Primary energy kWh/m2/year			78.0988 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
 Current environmental impact rating: B 87

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 32	-193 kg (14.9%)
U Solar photovoltaic panels	+ 9.6	-£ 453	-1042 kg (94.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£32	2.04 kg/m ²	B 86 B 88
Solar photovoltaic panels	£453	11.05 kg/m ²	A 95 A 97
Total Savings	£484	13.09 kg/m²	

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

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

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

	Current	Potential	Saving
Electricity	£112	£123	-£11
Mains gas	£300	£257	£43
Space heating	£235	£235	£0
Water heating	£82	£50	£32
Lighting	£95	£95	£0
Generated (PV)	-£0	-£453	£453
Total cost of fuels	£412	-£73	£485
Total cost of uses	£412	-£73	£485
Delivered energy	56 kWh/m ²	25 kWh/m ²	31 kWh/m ²
Carbon dioxide emissions	1.3 tonnes	0.1 tonnes	1.2 tonnes
CO2 emissions per m ²	14 kg/m ²	1 kg/m ²	13 kg/m ²
Primary energy	78 kWh/m ²	1 kWh/m ²	77 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1450 (1b)	2.3850 (2b)	112.4408 (1b) - (3b)
First floor	47.1450 (1c)	2.6860 (2c)	126.6315 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.2900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 239.0723 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				2 * 10 =	20.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.0837 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3337 (18)							
Number of sides sheltered					1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3086 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3935	0.3858	0.3781	0.3395	0.3318	0.2932	0.2932	0.2855	0.3086	0.3318	0.3472	0.3626 (22b)
Effective ac	0.5774	0.5744	0.5715	0.5576	0.5550	0.5430	0.5430	0.5408	0.5476	0.5550	0.5603	0.5658 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			12.2900	1.3258	16.3068		(27)
Flr - Ground			47.1450	0.1586	7.4760	75.6000	3564.1620 (28a)
Brick	86.4060	11.5330	74.8730	0.2500	18.7183	51.1900	3832.7489 (29a)
Render	12.8030	2.8800	9.9230	0.2500	2.4808	51.1900	507.9584 (29a)
Rf - Ins Joist	47.1450		47.1450	0.1000	4.7145	7.4000	348.8730 (30)
Total net area of external elements Aum(A, m2)			193.5060				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.0071		(33)
Party Wall			43.6110	0.0000	0.0000	7.4000	322.7214 (32)
Stud			91.2883			7.4000	675.5331 (32c)
Stud			101.1548			7.4000	748.5452 (32c)
Internal Floor			47.1450			7.4000	348.8730 (32d)
Internal Ceiling			47.1450			7.4000	348.8730 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10698.2880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							113.4615 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1559 (36)
Total fabric heat loss						(33) + (36) =	60.1631 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.5552	45.3180	45.0855	43.9935	43.7892	42.8381	42.8381	42.6619	43.2044	43.7892	44.2025	44.6346 (38)
Average = Sum(39)m / 12 =	105.7182	105.4810	105.2485	104.1565	103.9522	103.0011	103.0011	102.8250	103.3675	103.9522	104.3655	104.7977 (39)
HLP	1.1212	1.1187	1.1162	1.1046	1.1025	1.0924	1.0924	1.0905	1.0963	1.1025	1.1069	1.1114 (40)
HLP (average)												1.1046 (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												2.6800 (42)
Average daily hot water use (litres/day)												97.8502 (43)
Daily hot water use	107.6352	103.7212	99.8072	95.8932	91.9792	88.0652	88.0652	91.9792	95.8932	99.8072	103.7212	107.6352 (44)
Energy conte	159.6199	139.6046	144.0595	125.5945	120.5109	103.9918	96.3637	110.5787	111.8994	130.4079	142.3505	154.5834 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1539.5649 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.9430	20.9407	21.6089	18.8392	18.0766	15.5988	14.4546	16.5868	16.7849	19.5612	21.3526	23.1875	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6958	13.2599	14.6483	14.1196	14.5494	14.0330	14.4715	14.5220	14.0802	14.6074	14.1854	14.6807	(61)
Total heat required for water heating calculated for each month	174.3157	152.8645	158.7077	139.7141	135.0604	118.0248	110.8352	125.1008	125.9796	145.0153	156.5358	169.2641	(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												1.1780 (H8)	
Utilisation factor												0.5721 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												97.8502 (H14)	
Volume ratio Veff/V												0.7665 (H15)	
Solar storage volume factor												0.9468 (H16)	
Solar input												-863.8162 (H17)	
Solar input	-25.0490	-41.7995	-71.1893	-95.4077	-117.8682	-115.8832	-114.3518	-99.9097	-78.2494	-53.4351	-29.7117	-20.9617	(63)
												Solar input (sum of months) = Sum(63)m =	-863.8162 (63)
Output from w/h	149.2668	111.0650	87.5184	44.3064	17.1922	2.1416	0.0000	25.1910	47.7302	91.5802	126.8242	148.3024	(64)
												Total per year (kWh/year) = Sum(64)m =	851.1184 (64)
Heat gains from water heating, kWh/month	56.7476	49.7335	51.5618	45.2901	43.7073	38.0855	35.6588	40.3979	40.7266	47.0125	50.8779	55.0691	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.5603	52.9009	43.0219	32.5704	24.3467	20.5545	22.2099	28.8693	38.7483	49.1998	57.4235	61.2157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.2877	372.1094	362.4789	341.9767	316.0964	291.7725	275.5227	271.7010	281.3315	301.8337	327.7140	352.0379	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	(71)
Water heating gains (Table 5)	76.2736	74.0082	69.3035	62.9029	58.7463	52.8966	47.9285	54.2983	56.5647	63.1888	70.6637	74.0177	(72)
Total internal gains	614.4818	609.3787	585.1646	547.8102	509.5496	475.5839	456.0213	465.2288	487.0047	524.5826	566.1614	597.6314	(73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
North		5.5160	10.6334	0.7300		0.7200	0.7700	21.3641	(74)				
South		6.7760	46.7521	0.7300		0.7200	0.7700	115.3886	(78)				
Solar gains	136.7527	229.8046	310.0994	383.5056	433.6281	433.5453	416.6204	377.9247	334.8766	252.4294	163.1302	117.5165	(83)
Total gains	751.2345	839.1834	895.2640	931.3158	943.1777	909.1292	872.6417	843.1535	821.8813	777.0120	729.2916	715.1479	(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	28.1101	28.1733	28.2355	28.5315	28.5876	28.8516	28.8516	28.9010	28.7493	28.5876	28.4744	28.3570	
alpha	2.8740	2.8782	2.8824	2.9021	2.9058	2.9234	2.9234	2.9267	2.9166	2.9058	2.8983	2.8905	
util living area	0.9488	0.9289	0.8983	0.8434	0.7531	0.6164	0.4795	0.5104	0.6898	0.8514	0.9273	0.9547	(86)
MIT	19.1376	19.3733	19.7208	20.1554	20.5435	20.8236	20.9380	20.9238	20.7390	20.2532	19.6235	19.0871	(87)
Th 2	19.9836	19.9856	19.9876	19.9970	19.9988	20.0071	20.0071	20.0086	20.0039	19.9988	19.9952	19.9915	(88)
util rest of house	0.9410	0.9182	0.8826	0.8178	0.7099	0.5463	0.3849	0.4168	0.6260	0.8220	0.9146	0.9478	(89)
MIT 2	18.3009	18.5325	18.8723	19.2958	19.6551	19.8993	19.9802	19.9736	19.8330	19.3967	18.7887	18.2573	(90)
Living area fraction												fLA = Living area / (4) =	0.2008 (91)
MIT	18.4689	18.7013	19.0427	19.4684	19.8335	20.0849	20.1725	20.1644	20.0149	19.5686	18.9563	18.4239	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3189	18.5513	18.8927	19.3184	19.6835	19.9349	20.0225	20.0144	19.8649	19.4186	18.8063	18.2739	(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	0.9246	0.8994	0.8620	0.7975	0.6946	0.5407	0.3865	0.4174	0.6161	0.8019	0.8957	0.9324	(94)
Useful gains	694.6043	754.7730	771.6913	742.7491	655.1720	491.5824	337.2356	351.9582	506.3313	623.0704	653.2187	666.7947	(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	1482.0550	1439.9529	1304.3093	1085.1442	829.8993	549.5008	352.5185	371.6468	595.9057	916.7170	1221.7342	1474.9158	(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	585.8633	460.4408	396.2678	246.5245	129.9971	0.0000	0.0000	0.0000	0.0000	218.4731	409.3312	601.2421	(98)
Space heating												3048.1399	(98)
Space heating per m2												(98) / (4) =	32.3273 (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													3368.1104 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	585.8633	460.4408	396.2678	246.5245	129.9971	0.0000	0.0000	0.0000	0.0000	218.4731	409.3312	601.2421	(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)	647.3628	508.7744	437.8650	272.4028	143.6432	0.0000	0.0000	0.0000	0.0000	241.4067	452.2996	664.3559	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	149.2668	111.0650	87.5184	44.3064	17.1922	2.1416	0.0000	25.1910	47.7302	91.5802	126.8242	148.3024	(64)
Efficiency of water heater	89.8314	89.8599	89.9038	89.9974	90.1142	87.3000	87.3000	87.3000	87.3000	89.5307	89.7221	89.8484	(217)
Fuel for water heating, kWh/month	166.1632	123.5980	97.3467	49.2308	19.0782	2.4532	0.0000	28.8557	54.6738	102.2892	141.3523	165.0585	(219)
Water heating fuel used												950.0995	(219)
Annual totals kWh/year													
Space heating fuel - main system													3368.1104 (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)													420.7414 (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													3136.7119 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3368.1104	3.4800	117.2102	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	950.0995	3.4800	33.0635	(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	420.7414	13.1900	55.4958	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			114.4341	(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] =	0.3451 (257)
SAP value		95.1865
SAP rating (Section 12)		95 (258)
SAP band		A

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

Energy Emission factor Emissions

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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	3368.1104	0.2160	727.5119 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	950.0995	0.2160	205.2215 (264)
Space and water heating			932.7334 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	420.7414	0.5190	218.3648 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			319.5359 (272)
CO2 emissions per m2			3.3900 (273)
EI value			96.9260
EI rating			97 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	47.1450 (1b)	2.3850 (2b)	112.4408 (1b) - (3b)
First floor	47.1450 (1c)	2.6860 (2c)	126.6315 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.2900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 239.0723 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.0837 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3337 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3086 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.7000	5.2000	4.9000	4.5000	4.6000	4.2000	4.3000	4.2000	4.5000	4.9000	4.9000	5.2000 (22)
Wind factor	1.4250	1.3000	1.2250	1.1250	1.1500	1.0500	1.0750	1.0500	1.1250	1.2250	1.2250	1.3000 (22a)
Adj infilt rate												
Effective ac	0.4398	0.4012	0.3781	0.3472	0.3549	0.3241	0.3318	0.3241	0.3472	0.3781	0.3781	0.4012 (22b)
	0.5967	0.5805	0.5715	0.5603	0.5630	0.5525	0.5550	0.5525	0.5603	0.5715	0.5715	0.5805 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Solid Door			2.1200	1.0900	2.3108		(26)
Windows (Uw = 1.40)			12.2900	1.3258	16.3068		(27)
Flr - Ground			47.1450	0.1586	7.4760	75.6000	3564.1620 (28a)
Brick	86.4060	11.5330	74.8730	0.2500	18.7183	51.1900	3832.7489 (29a)
Render	12.8030	2.8800	9.9230	0.2500	2.4808	51.1900	507.9584 (29a)
Rf - Ins Joist	47.1450		47.1450	0.1000	4.7145	7.4000	348.8730 (30)
Total net area of external elements Aum(A, m2)			193.5060				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 52.0071		(33)
Party Wall			43.6110	0.0000	0.0000	7.4000	322.7214 (32)
Stud			91.2883			7.4000	675.5331 (32c)
Stud			101.1548			7.4000	748.5452 (32c)
Internal Floor			47.1450			7.4000	348.8730 (32d)
Internal Ceiling			47.1450			7.4000	348.8730 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10698.2880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							113.4615 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1559 (36)
Total fabric heat loss							(33) + (36) = 60.1631 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	47.0770	45.7971	45.0855	44.2025	44.4162	43.5895	43.7892	43.5895	44.2025	45.0855	45.0855	45.7971 (38)
Average = Sum(39)m / 12 =	107.2400	105.9601	105.2485	104.3655	104.5792	103.7526	103.9522	103.7526	104.3655	105.2485	105.2485	105.9601 (39)
												104.9728 (39)
HLP	1.1373	1.1238	1.1162	1.1069	1.1091	1.1004	1.1025	1.1004	1.1069	1.1162	1.1162	1.1238 (40)
HLP (average)												1.1133 (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												2.6800 (42)
Average daily hot water use (litres/day)												97.8502 (43)
Daily hot water use	107.6352	103.7212	99.8072	95.8932	91.9792	88.0652	88.0652	91.9792	95.8932	99.8072	103.7212	107.6352 (44)
Energy conte	159.6199	139.6046	144.0595	125.5945	120.5109	103.9918	96.3637	110.5787	111.8994	130.4079	142.3505	154.5834 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m =	1539.5649 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.9430	20.9407	21.6089	18.8392	18.0766	15.5988	14.4546	16.5868	16.7849	19.5612	21.3526	23.1875	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6958	13.2599	14.6483	14.1196	14.5494	14.0330	14.4715	14.5220	14.0802	14.6074	14.1854	14.6807	(61)
Total heat required for water heating calculated for each month													
	174.3157	152.8645	158.7077	139.7141	135.0604	118.0248	110.8352	125.1008	125.9796	145.0153	156.5358	169.2641	(62)
Aperture area of solar collector													
Zero-loss collector efficiency													3.0000 (H1)
Collector heat loss coefficient													0.7000 (H2)
Collector 2nd order heat loss coefficient													1.8000 (H3)
Collector effective heat loss coefficient													0.0050 (H3a)
Collector performance ratio													1.8063 (H3b)
Annual solar radiation per m2													2.5804 (H4)
Overshading factor													1254.2188 (H5)
Solar energy available													0.8000 (H6)
Adjustment factor for showers													2107.0876 (H7)
Solar-to-load ratio													1.0000 (H7a)
Utilisation factor													1.3686 (H8)
Collector performance factor													0.5184 (H9)
Dedicated solar storage volume													0.8793 (H10)
Effective solar volume													75.0000 (H11)
Daily hot water demand													75.0000 (H13)
Volume ratio Veff/V													97.8502 (H14)
Solar storage volume factor													0.7665 (H15)
Solar input													0.9468 (H16)
Solar input	-28.4913	-41.1982	-70.9864	-99.1495	-118.2171	-125.8853	-121.5633	-107.4007	-82.7398	-56.6352	-33.6997	-909.3935	(H17)
													-23.4269 (63)
													-909.3935 (63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h	145.8244	111.6663	87.7213	40.5647	16.8433	0.0000	0.0000	17.7001	43.2398	88.3801	122.8361	145.8371	(64)
Total per year (kWh/year) = Sum(64)m =													820.6132 (64)
Heat gains from water heating, kWh/month													
	56.7476	49.7335	51.5618	45.2901	43.7073	38.0855	35.6588	40.3979	40.7266	47.0125	50.8779	55.0691	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	160.8005	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.5603	52.9009	43.0219	32.5704	24.3467	20.5545	22.2099	28.8693	38.7483	49.1998	57.4235	61.2157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	368.2877	372.1094	362.4789	341.9767	316.0964	291.7725	275.5227	271.7010	281.3315	301.8337	327.7140	352.0379	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	53.7601	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	-107.2004	(71)
Water heating gains (Table 5)	76.2736	74.0082	69.3035	62.9029	58.7463	52.8966	47.9285	54.2983	56.5647	63.1888	70.6637	74.0177	(72)
Total internal gains	614.4818	609.3787	585.1646	547.8102	509.5496	475.5839	456.0213	465.2288	487.0047	524.5826	566.1614	597.6314	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
North	5.5160	13.4530	0.7300	0.7200	0.7700	27.0292 (74)							
South	6.7760	56.4170	0.7300	0.7200	0.7700	139.2426 (78)							
Solar gains	166.2718	241.8716	331.2842	431.1319	474.8129	516.1714	484.6118	441.2493	380.6105	285.8485	197.6818	140.4882	(83)
Total gains	780.7536	851.2503	916.4488	978.9421	984.3626	991.7552	940.6331	906.4781	867.6152	810.4311	763.8432	738.1196	(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	27.7112	28.0459	28.2355	28.4744	28.4162	28.6426	28.5876	28.6426	28.4744	28.2355	28.2355	28.0459	(86)
alpha	2.8474	2.8697	2.8824	2.8983	2.8944	2.9095	2.9058	2.9095	2.8983	2.8824	2.8824	2.8697	
util living area	0.9357	0.9196	0.8841	0.8137	0.6995	0.5347	0.4089	0.3931	0.6063	0.7972	0.8988	0.9411	
MIT	19.3414	19.4993	19.8434	20.2825	20.6628	20.8911	20.9630	20.9694	20.8405	20.4663	19.9039	19.3434	(87)
Th 2	19.9705	19.9815	19.9876	19.9952	19.9934	20.0005	19.9988	20.0005	19.9952	19.9876	19.9876	19.9815	(88)
util rest of house	0.9254	0.9073	0.8660	0.7836	0.6480	0.4579	0.3123	0.2914	0.5291	0.7559	0.8802	0.9315	(89)
MIT 2	18.4921	18.6529	18.9904	19.4119	19.7531	19.9408	19.9853	19.9905	19.9031	19.5834	19.0551	18.5031	(90)
Living area fraction												fLA = Living area / (4) =	
MIT	18.6626	18.8229	19.1616	19.5867	19.9357	20.1316	20.1816	20.1871	20.0913	19.7607	19.2255	18.6718	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5126	18.6729	19.0116	19.4367	19.7857	19.9816	20.0316	20.0371	19.9413	19.6107	19.0755	18.5218	(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	0.9071	0.8876	0.8451	0.7645	0.6363	0.4564	0.3156	0.2953	0.5246	0.7381	0.8596	0.9139	(94)	
Useful gains	708.1893	755.5731	774.4727	748.4057	626.3657	452.6404	296.8611	267.6928	455.1410	598.1547	656.5683	674.5311	(95)	
Ext temp.	5.4000	5.6000	7.1000	9.5000	12.6000	15.3000	17.1000	17.4000	15.1000	12.0000	8.6000	5.6000	(96)	
Heat loss rate W	1406.1968	1385.2022	1253.6835	1037.0477	751.4802	485.7305	304.7479	273.6012	505.2651	801.0120	1102.5362	1369.1944	(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	519.3175	423.1107	356.5328	207.8223	93.0852	0.0000	0.0000	0.0000	0.0000	150.9258	321.0969	516.8294	(98)	
Space heating												2588.7207	(98)	
Space heating per m2												(98) / (4) =	27.4549	(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														2860.4649	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	519.3175	423.1107	356.5328	207.8223	93.0852	0.0000	0.0000	0.0000	0.0000	150.9258	321.0969	516.8294	(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)	573.8315	467.5257	393.9589	229.6379	102.8566	0.0000	0.0000	0.0000	0.0000	166.7689	354.8032	571.0823	(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	145.8244	111.6663	87.7213	40.5647	16.8433	0.0000	0.0000	17.7001	43.2398	88.3801	122.8361	145.8371	(64)		
Efficiency of water heater	89.7785	89.8126	89.8497	89.9615	89.9946	87.3000	87.3000	87.3000	87.3000	89.2912	89.5913	89.7758	(217)		
Fuel for water heating, kWh/month	162.4269	124.3326	97.6312	45.0912	18.7159	0.0000	0.0000	20.2750	49.5301	98.9796	137.1071	162.4460	(219)		
Water heating fuel used												916.5355	(219)		
Annual totals kWh/year															
Space heating fuel - main system														2860.4649	(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)														420.7414	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV Unit 0 (0.80 * 2.50 * 1254 * 0.80) =										-2006.7501				-2006.7501	(233)
Total delivered energy for all uses														2315.9916	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2860.4649	4.2600	121.8558	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	916.5355	4.2600	39.0444	(247)
Pumps and fans for heating	75.0000	22.5500	16.9125	(249)
Pump for solar water heating	50.0000	22.5500	11.2750	(249)
Energy for lighting	420.7414	22.5500	94.8772	(250)
Additional standing charges			96.0000	(251)
Energy saving/generation technologies				
PV Unit	-2006.7501	22.5500	-452.5221	(252)
Total energy cost			-72.5573	(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	2860.4649	0.2160	617.8604	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	916.5355	0.2160	197.9717	(264)
Space and water heating			815.8321	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	420.7414	0.5190	218.3648	(268)
Energy saving/generation technologies				
PV Unit	-2006.7501	0.5190	-1041.5033	(269)
Total kg/year			57.5685	(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	2860.4649	1.2200	3489.7671 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	916.5355	1.2200	1118.1733 (264)
Space and water heating			4607.9404 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	420.7414	3.0700	1291.6760 (268)
Energy saving/generation technologies			
PV Unit	-2006.7501	3.0700	-6160.7228 (269)
Primary energy kWh/year			122.6436 (272)
Primary energy kWh/m2/year			1.3007 (273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	South East England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	113.5 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.61 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	363.70 (P1)
Transmission heat loss coefficient	60.16 (37)
Summer heat loss coefficient	423.86 (P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	5.5160	86.6589	0.7300	0.7200	0.7650	172.9803
South	6.7760	118.3991	0.7300	0.7200	0.7650	290.3227
total:						463.3029

Solar gains	Jun 489	Jul 463	Aug 422	(P3)
Internal gains	473	453	462	
Total summer gains	961	916	884	(P5)
Summer gain/loss ratio	2.27	2.16	2.08	(P6)
Summer external temperature	15.40	17.40	17.50	
Thermal mass temperature increment (TMP = 113.5)	1.21	1.21	1.21	
Threshold temperature	18.87	20.77	20.79	(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	628 - PRJ012992		Issued on Date	01/02/2023	
Assessment Reference	628	Prop Type Ref	Clover		
Property	Lancing Phase 2, BN15				
SAP Rating	84 B	DER	16.35	TER	17.33
Environmental	87 B	% DER<TER	5.67		
CO₂ Emissions (t/year)	1.29	DFEE	42.96	TFEE	49.50
General Requirements Compliance	Pass	% DFEE<TFEE	13.22		
Assessor Details	Chris Nicholls, , Tel: ,		Assessor ID	T850-0001	
Client					

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas			
Fuel factor	1.00 (mains gas)			
Target Carbon Dioxide Emission Rate (TER)	17.33	kgCO ₂ /m ²		
Dwelling Carbon Dioxide Emission Rate (DER)	16.35	kgCO ₂ /m ²		Pass
	-0.98 (-5.7%)	kgCO ₂ /m ²		

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.50	kWh/m ² /yr		
Dwelling Fabric Energy Efficiency (DFEE)	42.96	kWh/m ² /yr		
	-6.5 (-13.1%)	kWh/m ² /yr		Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.35 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

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

Calculation Type: New Build (As Designed)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (South East England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

5.52 m², No overhang

Windows facing South

6.78 m², No overhang

Air change rate

4.61 ach

Blinds/curtains

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

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Door U-value

1.09

W/m²K