

SAP Calculation

Calculation Method:-

L1A 2013 (2016 Revisions)

Dwelling:-

Land South of Sundown

Client:-

Mr & Mrs R Brooks

By:-



Results Summary

Option J Performance

Conditioned Energy	6675kWh/yr
Energy Reduction From PV	2136kWh
Energy Reduction From Renewables	32%
Final Conditioned Consumption	4539kWh

Revision J (Timber Frame + GSHP)	
Energy User	kWh/Year
Water Heating	1017.244
Space Heating (Main System)	3651.341
Space Heating (Secondary System)	1400.617
Pumps & Fans	30
Lighting	576.1345
	6675.3365
PV output	-2136.141
	4539.1955

Multiple iterations were explored to establish the lowest energy requirement with the addition of photovoltaic modules to the type offering the best performance. Aspects explored were form factor, construction, thermal mass and heating systems.

The results of the second, more efficient form factor are shown below

Rev	Construction	Heating System	PV (kWp)	DER/TER (%)	Energy kWh/Year	New Energy Consumption	Energy reduction (%)
A	Brick and Block	Gas System Boiler	0	-11.87% (Fail)	16289.2213	Baseline (100%)	0.00
B	Brick and Block	Gas System Boiler	2.5 (-2136.141 kWh)	28.01	14153.0803	86.89	13.11
C	Brick and Block	ASHP	0	17.9	8612.9832	52.88	47.12
E	Brick and Block	GSHP	0	34.26	7193.154	44.16	55.84
F	Timber Frame	ASHP	0	23.45	7989.7924	49.05	50.95
G	Timber Frame	GSHP	0	38.62	6675.3364	40.98	59.02
J	Timber Frame	GSHP	2.5 (-2136.141 kWh)	63.25	4539.1955	27.87	72.13

SAP 2013 (incorporating 2016 amendments for use in England) will allow the addition of photovoltaic modules but not the inclusion of battery storage; this is to be included in the new edition of Building Regulations which is believed to be due out sometime in 2020.

Design SAP Calculations

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0669 V2			Issued on Date	16/07/2019
Assessment Reference	Rev A	Prop Type Ref			
Property					
SAP Rating	82 B	DER	17.73	TER	15.85
Environmental	82 B	% DER<TER	-11.87		
CO ₂ Emissions (t/year)	2.77	DFEE	55.68	TFEE	61.71
General Requirements Compliance	Fail	% DFEE<TFEE	9.77		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com			Assessor ID	E477-0001
Client	HJ Concepts, HJC				

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

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

DWELLING AS DESIGNED

Detached House, total floor area 191 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) 15.85 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.73 kgCO₂/m²Fail
Excess emissions =1.88 kgCO₂/m² (11.9%)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)55.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (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
Post 98 Regular condens. with auto ign.

SAP default data

Fail

Secondary heating system: Room heaters - Wood Logs

Closed room heater

Efficiency: 65%
Minimum: 65% OK

5 Cylinder insulation

Hot water storage Nominal cylinder loss: 1.79 kWh/day
Permitted by DBSCG 2.30 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Programmer, room thermostat and TRVs Fail (TFA > 150)

Hot water controls:

Cylinderstat OK
Independent timer for DHW OK

Boiler interlock

Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North: 1.89 m², No overhang
Windows facing East: 21.37 m², No overhang
Windows facing South: 2.49 m², No overhang
Windows facing West: 11.43 m², Overhang twice as wide as window, ratio 1.88
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Window U-value 1.10 W/m²K
Secondary heating (wood logs)
Secondary heating fuel: wood logs

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																6 * 10 =	60.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000 / (5) =	0.1297 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.3797 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3797 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	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)				
	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462	(22b)				
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	245.5778	244.8831	244.2022	241.0041	240.4058	237.6203	237.6203	237.1045	238.6932	240.4058	241.6162	242.8817 (39)
Average = Sum(39)m / 12 =												241.0012 (39)
HLP	1.2866	1.2829	1.2793	1.2626	1.2595	1.2449	1.2449	1.2422	1.2505	1.2595	1.2658	1.2724 (40)
HLP (average)												1.2626 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	Jan 115.7349	Feb 111.5263	Mar 107.3178	Apr 103.1092	May 98.9007	Jun 94.6922	Jul 94.6922	Aug 98.9007	Sep 103.1092	Oct 107.3178	Nov 111.5263	Dec 115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	599.7562	597.4377	577.5059	544.7514	510.3333	478.0559	457.6459	464.3649	481.6767	514.6716	552.6540	582.2573 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.8900	10.6334	0.6300	0.7000	0.7700		6.1419 (74)	
East					21.3700	19.6403	0.6300	0.7000	0.7700		128.2696 (76)	
South					2.4900	46.7521	0.6300	0.7000	0.7700		35.5772 (78)	
West					11.4300	19.6403	0.6300	0.7000	0.7700		68.6065 (80)	

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	838.3514	1052.5730	1305.9284	1585.6993	1774.5573	1768.8763	1687.8137	1527.4491	1320.8562	1048.4801	847.8834	780.0208 (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	53.9770	54.1301	54.2811	55.0014	55.1383	55.7846	55.7846	55.9060	55.5339	55.1383	54.8620	54.5762
alpha	4.5985	4.6087	4.6187	4.6668	4.6759	4.7190	4.7190	4.7271	4.7023	4.6759	4.6575	4.6384
util living area	0.9995	0.9983	0.9937	0.9726	0.9041	0.7576	0.5932	0.6654	0.9020	0.9899	0.9988	0.9996 (86)
MIT	19.7661	19.8993	20.1326	20.4451	20.7136	20.8770	20.9264	20.9157	20.7772	20.4130	20.0341	19.7501 (87)
Th 2	19.8514	19.8542	19.8570	19.8703	19.8727	19.8843	19.8843	19.8864	19.8798	19.8727	19.8677	19.8625 (88)
util rest of house	0.9990	0.9977	0.9912	0.9610	0.8630	0.6623	0.4558	0.5271	0.8421	0.9842	0.9982	0.9995 (89)
MIT 2	18.7193	18.8544	19.0891	19.4072	19.6580	19.7963	19.8228	19.8213	19.7253	19.3816	19.0005	18.7123 (90)
Living area fraction	18.8623	18.9974	19.2319	19.5493	19.8025	19.9442	19.9738	19.9711	19.8693	19.5228	19.1420	18.8544 (91)
MIT	18.8623	18.9974	19.2319	19.5493	19.8025	19.9442	19.9738	19.9711	19.8693	19.5228	19.1420	18.8544 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8623	18.9974	19.2319	19.5493	19.8025	19.9442	19.9738	19.9711	19.8693	19.5228	19.1420	18.8544 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	837.5376	1049.5005	1292.0394	1517.1711	1525.9345	1181.6543	788.9704	822.6973	1111.3257	1029.2915	845.9553	779.4877 (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	3576.1830	3452.2228	3109.1638	2566.5134	1947.8801	1269.8961	801.6952	846.7190	1377.0891	2145.0815	2909.5484	3559.2806 (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	2037.5522	1614.6294	1351.9405	755.5265	313.9276	0.0000	0.0000	0.0000	0.0000	830.1477	1485.7870	2068.1660 (98)

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Space heating 10457.6768 (98)
Space heating per m2 (98) / (4) = 54.7867 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													84.0000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													11204.6538 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2037.5522	1614.6294	1351.9405	755.5265	313.9276	0.0000	0.0000	0.0000	0.0000	830.1477	1485.7870	2068.1660	(98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)
Space heating fuel (main heating system)	2183.0916	1729.9601	1448.5077	809.4927	336.3509	0.0000	0.0000	0.0000	0.0000	889.4440	1591.9146	2215.8921	(211)
Water heating requirement	313.4696	248.4045	207.9909	116.2348	48.2965	0.0000	0.0000	0.0000	0.0000	127.7150	228.5826	318.1794	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	82.7779	82.6592	82.3737	81.6248	79.7648	74.0000	74.0000	74.0000	74.0000	81.7281	82.5201	82.8195	(216)
Fuel for water heating, kWh/month	271.6993	239.8160	252.7210	228.6103	229.2427	220.7761	212.0145	232.6695	232.2661	236.7569	247.9633	265.0241	(219)
Water heating fuel used												2869.5597	(219)
Annual totals kWh/year													
Space heating fuel - main system												11204.6538	(211)
Space heating fuel - secondary												1608.8734	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Total delivered energy for all uses												16289.2213	(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	11204.6538	0.2160	2420.2052	(261)
Space heating - secondary	1608.8734	0.0190	30.5686	(263)
Water heating (other fuel)	2869.5597	0.2160	619.8249	(264)
Space and water heating			3070.5987	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Total CO2, kg/year			3385.1825	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.7300	(273)

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

DER		17.7300	ZC1
Total Floor Area	TFA	190.8800	
Assumed number of occupants	N	2.9900	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		11.2472	ZC2
CO2 emissions from cooking, equation (L16)		0.9994	ZC3
Total CO2 emissions		29.9766	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.9766	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (U _w = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements A _{um} (A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (56)												
If cylinder contains dedicated solar storage												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
223.3780 196.8488 206.6466 185.1230 181.3261 161.8946 155.3617 170.6464 170.3972 191.9678 203.1398 217.9625 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625 (64)
Total per year (kWh/year) = Sum(64)m =												2264.6926 (64)
Heat gains from water heating, kWh/month												
98.4647 87.3026 92.9015 84.9645 84.4824 77.2411 75.8493 80.9315 80.0682 88.0208 90.9551 96.6641 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
32.6231 28.9756 23.5645 17.8399 13.3355 11.2584 12.1651 15.8126 21.2237 26.9484 31.4527 33.5298 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
362.2933 366.0527 356.5790 336.4105 310.9514 287.0235 271.0381 267.2787 276.7524 296.9209 322.3800 346.3079 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 (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)												
-119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 (71)												
Water heating gains (Table 5)												
132.3451 129.9147 124.8677 118.0063 113.5517 107.2793 101.9480 108.7789 111.2059 118.3076 126.3266 129.9248 (72)												
Total internal gains	598.1121	595.7936	575.8618	543.1073	508.6892	476.4118	456.0018	462.7208	480.0326	513.0274	551.0099	580.6132 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)
East	21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)
South	2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)
West	11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	836.7073	1050.9289	1304.2843	1584.0552	1772.9132	1767.2322	1686.1696	1525.8050	1319.2121	1046.8360	846.2392	778.3767 (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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000
util living area	0.9995	0.9984	0.9936	0.9710	0.8970	0.7427	0.5757	0.6486	0.8949	0.9897	0.9988	0.9997 (86)
MIT	19.5049	19.6800	19.9848	20.3878	20.7301	20.9271	20.9832	20.9711	20.8044	20.3367	19.8455	19.4795 (87)
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054 (88)
util rest of house												
0.9993 0.9978 0.9911 0.9591 0.8547 0.6489 0.4450 0.5155 0.8338 0.9838 0.9983 0.9995 (89)												
MIT 2	17.8906	18.1483	18.5943	19.1807	19.6434	19.8733	19.9165	19.9121	19.7520	19.1164	18.3982	17.8595 (90)
Living area fraction									fLA = Living area / (4) =			0.1369 (91)
MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9988 0.9965 0.9873 0.9507 0.8490 0.6580 0.4627 0.5331 0.8322 0.9787 0.9973 0.9992 (94)												
Useful gains	835.7296	1047.2189	1287.7359	1505.9743	1505.2837	1162.8179	780.2572	813.4162	1097.8307	1024.5788	843.9235	777.7367 (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												
3241.1589 3150.8497 2869.5702 2413.8371 1866.1266 1237.4841 790.9136 833.8799 1328.8209 2002.4784 2662.0772 3228.1329 (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	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948 (98)
Space heating												9162.0152 (98)
Space heating per m2												(98) / (4) = 47.9988 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													9798.9467 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1914.0529	1511.9144	1258.7002	699.1029	287.1306	0.0000	0.0000	0.0000	0.0000	778.1361	1400.0756	1949.8340	(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	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625	(64)
Efficiency of water heater (217)m	89.1732	89.0407	88.7231	87.8988	85.8590	79.8000	79.8000	79.8000	79.8000	88.0356	88.8987	89.2224	(216)
Fuel for water heating, kWh/month	250.4991	221.0774	232.9118	210.6092	211.1906	202.8754	194.6888	213.8427	213.5304	218.0569	228.5069	244.2911	(219)
Water heating fuel used												2642.0803	(219)
Annual totals kWh/year													
Space heating fuel - main system												9798.9467	(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)												576.1345	(232)
Total delivered energy for all uses												13092.1615	(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	9798.9467	0.2160	2116.5725 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2642.0803	0.2160	570.6893 (264)
Space and water heating			2687.2618 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total CO2, kg/m2/year			3025.2006 (272)
Emissions per m2 for space and water heating			14.0783 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.5665 (272b)
Emissions per m2 for pumps and fans			0.2039 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0783 * 1.00) + 1.5665 + 0.2039, rounded to 2 d.p.			15.8500 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.0865 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3365 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3365	(21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954	(22b)				
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	241.7357	241.1902	240.6556	238.1444	237.6745	235.4873	235.4873	235.0823	236.3298	237.6745	238.6250	239.6187 (39)
Average = Sum(39)m / 12 =												238.1421 (39)
HLP	1.2664	1.2636	1.2608	1.2476	1.2452	1.2337	1.2337	1.2316	1.2381	1.2452	1.2501	1.2553 (40)
HLP (average)												1.2476 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)		
East					21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)		
South					2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)		
West					11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)		

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262 (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	54.8349	54.9589	55.0810	55.6618	55.7719	56.2899	56.2899	56.3869	56.0892	55.7719	55.5497	55.3194	
alpha	4.6557	4.6639	4.6721	4.7108	4.7181	4.7527	4.7527	4.7591	4.7393	4.7181	4.7033	4.6880	
util living area	0.9997	0.9989	0.9952	0.9772	0.9149	0.7758	0.6126	0.6889	0.9173	0.9927	0.9992	0.9998	(86)
MIT	19.4164	19.5930	19.9029	20.3169	20.6803	20.9050	20.9761	20.9594	20.7614	20.2681	19.7652	19.3911	(87)
Th 2	19.8672	19.8695	19.8717	19.8821	19.8840	19.8931	19.8931	19.8948	19.8896	19.8840	19.8801	19.8760	(88)
util rest of house	0.9996	0.9984	0.9933	0.9673	0.8770	0.6825	0.4736	0.5502	0.8636	0.9885	0.9989	0.9997	(89)
MIT 2	18.4155	18.5937	18.9045	19.3206	19.6616	19.8480	19.8870	19.8827	19.7459	19.2785	18.7743	18.3971	(90)
Living area fraction									fLA = Living area / (4) =			0.1369	(91)
MIT	18.5525	18.7305	19.0411	19.4570	19.8010	19.9927	20.0361	20.0301	19.8849	19.4140	18.9100	18.5331	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5525	18.7305	19.0411	19.4570	19.8010	19.9927	20.0361	20.0301	19.8849	19.4140	18.9100	18.5331	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9994	0.9978	0.9913	0.9624	0.8736	0.6919	0.4927	0.5688	0.8633	0.9859	0.9984	0.9996	(94)
Ext temp.	749.8971	963.3665	1210.0099	1446.3614	1479.3211	1169.3014	793.5901	823.6632	1070.9747	951.9441	760.9015	692.6215	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3445.3454	3335.7900	3018.0956	2514.0874	1925.4094	1269.9084	809.1577	853.3788	1367.1380	2094.8551	2818.1576	3434.4847	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	2005.4136	1594.2686	1345.2158	768.7628	331.8897	0.0000	0.0000	0.0000	0.0000	850.3258	1481.2244	2039.9462	(98)
Space heating per m2												10417.0468	(98)
												(98) / (4) =	54.5738 (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	2213.5807	1742.6061	1786.6253	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8066	0.8808	0.8363	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1785.5351	1534.9229	1494.1159	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	236.5114	359.5070	250.4275	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												846.4458 (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	59.1278	89.8767	62.6069	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												211.6115 (107)
Space cooling per m2												1.1086 (108)
Energy for space heating												54.5738 (99)
Energy for space cooling												1.1086 (108)
Total												55.6824 (109)
Dwelling Fabric Energy Efficiency (DFEE)												55.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (Uw = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North				1.8900	10.6334		0.6300	0.7000	0.7700	6.1419 (74)		
East				21.3700	19.6403		0.6300	0.7000	0.7700	128.2696 (76)		
South				2.4900	46.7521		0.6300	0.7000	0.7700	35.5772 (78)		
West				11.4300	19.6403		0.6300	0.7000	0.7700	68.6065 (80)		
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262 (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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001	
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000	
util living area	0.9997	0.9989	0.9951	0.9762	0.9102	0.7645	0.5988	0.6756	0.9127	0.9926	0.9993	0.9998	(86)
MIT	19.4631	19.6389	19.9453	20.3533	20.7062	20.9171	20.9802	20.9655	20.7808	20.2990	19.8048	19.4380	(87)
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054	(88)
util rest of house	0.9996	0.9985	0.9932	0.9661	0.8714	0.6719	0.4647	0.5405	0.8579	0.9883	0.9989	0.9997	(89)
MIT 2	18.4852	18.6626	18.9699	19.3799	19.7098	19.8835	19.9176	19.9141	19.7876	19.3324	18.8370	18.4671	(90)
Living area fraction									fLA = Living area / (4) =			0.1369	(91)
MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9994	0.9979	0.9913	0.9613	0.8685	0.6817	0.4831	0.5588	0.8582	0.9858	0.9985	0.9996	(94)
Ext temp.	749.9234	963.4251	1209.9958	1444.7370	1470.7292	1152.1055	778.2149	809.1015	1064.5675	951.8191	760.9442	692.6405	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3360.2576	3253.4532	2944.0321	2452.4675	1878.5794	1239.1841	791.0345	834.1019	1335.1239	2044.2913	2748.4918	3348.7675	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1942.0886	1538.8989	1290.1230	725.5659	303.4405	0.0000	0.0000	0.0000	0.0000	812.7993	1431.0343	1976.1585	(98)
Space heating per m2												10020.1090	(98)
												(98) / (4) =	52.4943 (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	2147.1638	1690.3204	1732.9265	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8231	0.8940	0.8517	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1767.3076	1511.1832	1476.0148	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	249.6352	377.1693	263.8947	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												890.6992 (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	62.4088	94.2923	65.9737	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												222.6748 (107)
Space cooling per m2												1.1666 (108)
Energy for space heating												52.4943 (99)
Energy for space cooling												1.1666 (108)
Total												53.6609 (109)
Target Fabric Energy Efficiency (TFEE)												61.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
Effective ac	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	239.8212	238.6932	238.6932	237.1045	237.1045	235.1787	235.6395	234.7317	235.1787	236.1141	236.1141	237.6203 (39)
Average = Sum(39)m / 12 =												236.8328 (39)
HLP	1.2564	1.2505	1.2505	1.2422	1.2422	1.2321	1.2345	1.2297	1.2321	1.2370	1.2370	1.2449 (40)
HLP (average)												1.2407 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
RHI water heating demand												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	or Table 6b	Specific data	factor	W						
		W/m2		or Table 6c	Table 6d							
North	1.8900	11.9814	0.6300	0.7000	0.7700	6.9206 (74)						
East	21.3700	22.3313	0.6300	0.7000	0.7700	145.8447 (76)						
South	2.4900	50.9848	0.6300	0.7000	0.7700	38.7982 (78)						
West	11.4300	22.3313	0.6300	0.7000	0.7700	78.0068 (80)						
Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284 (83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305 (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	55.2727	55.5339	55.5339	55.9060	55.9060	56.3637	56.2535	56.4711	56.3637	56.1405	56.1405	55.7846
alpha	4.6848	4.7023	4.7023	4.7271	4.7271	4.7576	4.7502	4.7647	4.7576	4.7427	4.7427	4.7190
util living area	0.9975	0.9946	0.9828	0.9340	0.8021	0.5499	0.3692	0.4078	0.7513	0.9628	0.9941	0.9981 (86)
MIT	19.9751	20.0904	20.3244	20.6184	20.8374	20.9301	20.9414	20.9407	20.8871	20.6014	20.2425	19.9602 (87)
Th 2	19.8751	19.8798	19.8798	19.8864	19.8864	19.8944	19.8925	19.8963	19.8944	19.8905	19.8905	19.8843 (88)
util rest of house	0.9966	0.9926	0.9762	0.9083	0.7319	0.4365	0.2384	0.2691	0.6450	0.9426	0.9914	0.9974 (89)
MIT 2	18.9475	19.0661	19.2974	19.5833	19.7687	19.8336	19.8353	19.8391	19.8138	19.5773	19.2270	18.9404 (90)
Living area fraction									fLA = Living area / (4) =			0.1369 (91)
MIT	19.0882	19.2063	19.4380	19.7250	19.9150	19.9837	19.9867	19.9899	19.9607	19.7175	19.3661	19.0800 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0882	19.2063	19.4380	19.7250	19.9150	19.9837	19.9867	19.9899	19.9607	19.7175	19.3661	19.0800 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9957	0.9910	0.9728	0.9038	0.7339	0.4461	0.2497	0.2810	0.6522	0.9385	0.9897	0.9967 (94)
Useful gains	1139.6807	1320.0437	1525.3534	1682.2370	1470.4739	925.0356	491.1986	513.1631	1050.6519	1247.1991	1136.4726	1068.7295 (95)
Ext temp	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W												
	3354.6583	3247.7382	2873.3822	2329.5500	1639.5699	936.8761	491.7072	514.0430	1119.6245	1916.6581	2683.6850	3321.9380 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	1647.9433	1295.4107	1002.9334	466.0654	125.8074	0.0000	0.0000	0.0000	0.0000	498.0775	1113.9930	1676.3871 (98)
Space heating												7826.6179 (98)
RHI space heating demand												7827 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	245.5778	244.8831	244.2022	241.0041	240.4058	237.6203	237.6203	237.1045	238.6932	240.4058	241.6162	242.8817 (39)
Average = Sum(39)m / 12 =												241.0012 (39)
HLP	1.2866	1.2829	1.2793	1.2626	1.2595	1.2449	1.2449	1.2422	1.2505	1.2595	1.2658	1.2724 (40)
HLP (average)												1.2626 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.8900	10.6334	0.6300	0.7000	0.7700		6.1419 (74)	
East					21.3700	19.6403	0.6300	0.7000	0.7700		128.2696 (76)	
South					2.4900	46.7521	0.6300	0.7000	0.7700		35.5772 (78)	
West					11.4300	19.6403	0.6300	0.7000	0.7700		68.6065 (80)	
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	1113.6096	1324.2114	1564.7841	1826.0343	1995.5962	1975.0142	1887.4383	1730.6933	1536.8832	1283.0278	1101.7271	1048.7656 (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	53.9770	54.1301	54.2811	55.0014	55.1383	55.7846	55.7846	55.9060	55.5339	55.1383	54.8620	54.5762
alpha	4.5985	4.6087	4.6187	4.6668	4.6759	4.7190	4.7190	4.7271	4.7023	4.6759	4.6575	4.6384
util living area	0.9982	0.9956	0.9870	0.9547	0.8672	0.7035	0.5382	0.6019	0.8519	0.9780	0.9963	0.9986 (86)
MIT	19.8646	19.9957	20.2216	20.5178	20.7592	20.8949	20.9318	20.9249	20.8200	20.4914	20.1247	19.8467 (87)
Th 2	19.8514	19.8542	19.8570	19.8703	19.8727	19.8843	19.8843	19.8864	19.8798	19.8727	19.8677	19.8625 (88)
util rest of house	0.9975	0.9941	0.9822	0.9373	0.8173	0.6062	0.4097	0.4699	0.7774	0.9665	0.9947	0.9982 (89)
MIT 2	18.8173	18.9503	19.1765	19.4750	19.6940	19.8057	19.8242	19.8242	19.7552	19.4569	19.0907	18.8088 (90)
Living area fraction	18.9607	19.0934	19.3196	19.6178	19.8398	19.9548	19.9758	19.9749	19.9009	19.5985	19.2322	18.9509 (91)
MIT	18.9607	19.0934	19.3196	19.6178	19.8398	19.9548	19.9758	19.9749	19.9009	19.5985	19.2322	18.9509 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9607	19.0934	19.3196	19.6178	19.8398	19.9548	19.9758	19.9749	19.9009	19.5985	19.2322	18.9509 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1110.1166	1314.5697	1532.3160	1702.6895	1627.7015	1210.5499	793.9710	832.5603	1197.3196	1235.1796	1094.4879	1046.2771 (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	3600.3413	3475.7288	3130.5671	2583.0295	1956.8624	1272.3997	802.1667	847.6210	1384.6421	2163.2853	2931.3471	3582.7124 (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	1852.7272	1452.2989	1189.0989	633.8448	244.8958	0.0000	0.0000	0.0000	0.0000	690.5106	1322.5386	1887.1078 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 9273.0226 (98)
48.5804 (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) 0.1000 (201)
Fraction of space heat from main system(s) 0.9000 (202)
Efficiency of main space heating system 1 (in %) 84.0000 (206)
Efficiency of secondary/supplementary heating system, % 65.0000 (208)
Space heating requirement 9935.3813 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1852.7272	1452.2989	1189.0989	633.8448	244.8958	0.0000	0.0000	0.0000	0.0000	690.5106	1322.5386	1887.1078	(98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)
Space heating fuel (main heating system)	1985.0648	1556.0345	1274.0345	679.1194	262.3883	0.0000	0.0000	0.0000	0.0000	739.8328	1417.0057	2021.9012	(211)
Water heating requirement	285.0349	223.4306	182.9383	97.5146	37.6763	0.0000	0.0000	0.0000	0.0000	106.2324	203.4675	290.3243	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	82.6722	82.5313	82.1913	81.2923	79.1500	74.0000	74.0000	74.0000	74.0000	81.3886	82.3672	82.7207	(216)
Fuel for water heating, kWh/month	272.0467	240.1875	253.2819	229.5454	231.0234	220.7761	212.0145	232.6695	232.2661	237.7444	248.4234	265.3405	(219)
Water heating fuel used												2875.3195	(219)
Annual totals kWh/year													
Space heating fuel - main system												9935.3813	(211)
Space heating fuel - secondary												1426.6189	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Total delivered energy for all uses												14843.4541	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9935.3813	3.4800	345.7513	(240)
Space heating - secondary	1426.6189	4.2300	60.3460	(242)
Water heating (other fuel)	2875.3195	3.4800	100.0611	(247)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Energy for lighting	576.1345	13.1900	75.9921	(250)
Additional standing charges			120.0000	(251)
Total energy cost			706.1075	(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] = 1.2573 (257)
SAP value 82.4611
SAP rating (Section 12) 82 (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	9935.3813	0.2160	2146.0424	(261)
Space heating - secondary	1426.6189	0.0190	27.1058	(263)
Water heating (other fuel)	2875.3195	0.2160	621.0690	(264)
Space and water heating			2794.2171	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Total kg/year			3108.8009	(272)
CO2 emissions per m2			16.2900	(273)
EI value			82.3394	
EI rating			82	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.25) / 0.8400 = 4.443$, stars = 4
Main heating environmental impact $0.216 \times (1 + 0.29 \times 0.25) / 0.8400 = 0.2758$, stars = 4
Water heating energy efficiency $3.48 / 0.7919 = 4.394$, stars = 4

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Calculation Type: New Build (As Designed)

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Water heating environmental impact

$0.216 / 0.7919 = 0.2728$, stars = 4

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
Effective ac	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	239.8212	238.6932	238.6932	237.1045	237.1045	235.1787	235.6395	234.7317	235.1787	236.1141	236.1141	237.6203 (39)
Average = Sum(39)m / 12 =												236.8328 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2564	1.2505	1.2505	1.2422	1.2422	1.2321	1.2345	1.2297	1.2321	1.2370	1.2370	1.2449 (40)
HLP (average)												1.2407 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.8900	11.9814	0.6300	0.7000	0.7700	6.9206 (74)
East	21.3700	22.3313	0.6300	0.7000	0.7700	145.8447 (76)
South	2.4900	50.9848	0.6300	0.7000	0.7700	38.7982 (78)
West	11.4300	22.3313	0.6300	0.7000	0.7700	78.0068 (80)

Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284 (83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305 (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	55.2727	55.5339	55.5339	55.9060	55.9060	56.3637	56.2535	56.4711	56.3637	56.1405	56.1405	55.7846
alpha	4.6848	4.7023	4.7023	4.7271	4.7271	4.7576	4.7502	4.7647	4.7576	4.7427	4.7427	4.7190
util living area	0.9975	0.9946	0.9828	0.9340	0.8021	0.5499	0.3692	0.4078	0.7513	0.9628	0.9941	0.9981 (86)
MIT	19.9751	20.0904	20.3244	20.6184	20.8374	20.9301	20.9414	20.9407	20.8871	20.6014	20.2425	19.9602 (87)
Th 2	19.8751	19.8798	19.8798	19.8864	19.8864	19.8944	19.8925	19.8963	19.8944	19.8905	19.8905	19.8843 (88)
util rest of house	0.9966	0.9926	0.9762	0.9083	0.7319	0.4365	0.2384	0.2691	0.6450	0.9426	0.9914	0.9974 (89)
MIT 2	18.9475	19.0661	19.2974	19.5833	19.7687	19.8336	19.8353	19.8391	19.8138	19.5773	19.2270	18.9404 (90)
Living area fraction	19.0882	19.2063	19.4380	19.7250	19.9150	19.9837	19.9867	19.9899	19.9607	19.7175	19.3661	19.0800 (92)
MIT	19.0882	19.2063	19.4380	19.7250	19.9150	19.9837	19.9867	19.9899	19.9607	19.7175	19.3661	19.0800 (93)
Temperature adjustment												0.0000
adjusted MIT	19.0882	19.2063	19.4380	19.7250	19.9150	19.9837	19.9867	19.9899	19.9607	19.7175	19.3661	19.0800 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1139.6807	1320.0437	1525.3534	1682.2370	1470.4739	925.0356	491.1986	513.1631	1050.6519	1247.1991	1136.4726	1068.7295 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	3354.6583	3247.7382	2873.3822	2329.5500	1639.5699	936.8761	491.7072	514.0430	1119.6245	1916.6581	2683.6850	3321.9380 (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	1647.9433	1295.4107	1002.9334	466.0654	125.8074	0.0000	0.0000	0.0000	0.0000	498.0775	1113.9930	1676.3871 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating 7826.6179 (98)
Space heating per m2 (98) / (4) = 41.0028 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													84.0000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													8385.6620 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1647.9433	1295.4107	1002.9334	466.0654	125.8074	0.0000	0.0000	0.0000	0.0000	498.0775	1113.9930	1676.3871	(98)
Space heating efficiency (main heating system 1)													
	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)
Space heating fuel (main heating system)													
	1765.6536	1387.9401	1074.5715	499.3558	134.7936	0.0000	0.0000	0.0000	0.0000	533.6545	1193.5639	1796.1291	(211)
Water heating requirement													
	253.5297	199.2940	154.2975	71.7024	19.3550	0.0000	0.0000	0.0000	0.0000	76.6273	171.3835	257.9057	(215)
Water heating requirement													
	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater													
(217)m	82.5314	82.3822	81.9252	80.6446	77.5296	74.0000	74.0000	74.0000	74.0000	80.7115	82.1191	82.5827	(216)
Fuel for water heating, kWh/month													
	272.5107	240.6222	254.1045	231.3889	235.8520	220.7761	212.0145	232.6695	232.2661	239.7389	249.1742	265.7840	(219)
Water heating fuel used													
												2886.9017	(219)
Annual totals kWh/year													
Space heating fuel - main system													8385.6620 (211)
Space heating fuel - secondary													1204.0951 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													30.0000 (231)
Electricity for lighting (calculated in Appendix L)													576.1345 (232)
Total delivered energy for all uses													13082.7932 (238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	8385.6620	3.9300	329.5565 (240)
Space heating - secondary	1204.0951	4.6500	55.9904 (242)
Water heating (other fuel)	2886.9017	3.9300	113.4552 (247)
Pumps and fans for heating	30.0000	17.5600	5.2680 (249)
Energy for lighting	576.1345	17.5600	101.1692 (250)
Additional standing charges			88.0000 (251)
Total energy cost			693.4394 (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	8385.6620	0.2160	1811.3030 (261)
Space heating - secondary	1204.0951	0.0190	22.8778 (263)
Water heating (other fuel)	2886.9017	0.2160	623.5708 (264)
Space and water heating			2457.7516 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total kg/year			2772.3354 (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	8385.6620	1.2200	10230.5077 (261)
Space heating - secondary	1204.0951	1.0400	1252.2589 (263)
Water heating (other fuel)	2886.9017	1.2200	3522.0200 (264)
Space and water heating			15004.7866 (265)
Pumps and fans	30.0000	3.0700	92.1000 (267)
Energy for lighting	576.1345	3.0700	1768.7328 (268)
Primary energy kWh/year			16865.6194 (272)
Primary energy kWh/m2/year			88.3572 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 82
Current environmental impact rating: B 82

(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		Recommended
L2			Not considered
Q3			Not considered
O3			Not considered
Recommended measures:			
N	Solar water heating	SAP change + 1.1	Cost change -£ 48
U	Solar photovoltaic panels	+ 5.7	-£ 320
V2	Wind turbine	+ 11.7	-£ 628
			CO2 change
			-289 kg (10.4%)
			-947 kg (38.1%)
			-1856 kg (120.8%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£48	1.51 kg/m²	B 84 B 84
Solar photovoltaic panels	£320	4.96 kg/m²	B 89 B 89
Wind turbine	£628	9.72 kg/m²	A 101 A 100
Total Savings	£996	16.20 kg/m²	

Potential energy efficiency rating: A 101
Potential environmental impact rating: A 100

Fuel prices for cost data on this page from database revision number 445 TEST (30 Jul 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£106	£115	-£9
Mains gas	£531	£474	£57
Wood	£56	£56	-£0
Space heating	£479	£482	-£3
Water heating	£113	£63	£51
Lighting	£101	£101	£0
Generated (PV)	-£0	-£320	£320
Generated (wind)	-£0	-£628	£628
Total cost of fuels	£693	-£303	£996
Total cost of uses	£693	-£302	£996
Delivered energy	69 kWh/m²	33 kWh/m²	36 kWh/m²
Carbon dioxide emissions	2.8 tonnes	-0.3 tonnes	3.1 tonnes
CO2 emissions per m²	15 kg/m²	-2 kg/m²	16 kg/m²
Primary energy	88 kWh/m²	-7 kWh/m²	95 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																6 * 10 =	60.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000	/ (5) =	0.1297 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3797 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3797	(21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462	(22b)				
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	245.5778	244.8831	244.2022	241.0041	240.4058	237.6203	237.6203	237.1045	238.6932	240.4058	241.6162	242.8817 (39)
Average = Sum(39)m / 12 =												241.0012 (39)
HLP	1.2866	1.2829	1.2793	1.2626	1.2595	1.2449	1.2449	1.2422	1.2505	1.2595	1.2658	1.2724 (40)
HLP (average)												1.2626 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage												
19.2942	17.4270	19.2942	18.6718	19.2942	18.6718	19.2942	19.2942	18.6718	19.2942	18.6718	19.2942	19.2942 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	214.1881	188.5482	196.0609	169.4758	159.3418	140.3943	133.1448	149.3600	156.1008	181.3821	194.2463	208.7725 (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												1.0956 (H8)
Utilisation factor												0.5986 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												115.5000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												1.0978 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-954.5690 (H17)
Solar input	-27.6806	-46.1910	-78.6685	-105.4313	-130.2515	-128.0579	-126.3656	-110.4063	-86.4703	-59.0490	-32.8332	-23.1639 (63)
Solar input (sum of months) = Sum(63)m =												-954.5690 (63)
Output from w/h	186.5075	142.3572	117.3924	64.0445	29.0903	12.3364	6.7792	38.9537	69.6306	122.3331	161.4131	185.6086 (64)
Total per year (kWh/year) = Sum(64)m =												1136.4465 (64)
Heat gains from water heating, kWh/month	91.1127	80.6621	84.4330	72.4468	66.8950	60.0409	58.0758	63.9023	68.6311	79.5523	83.8403	89.3121 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	122.4634	120.0330	113.4852	100.6206	89.9126	83.3901	78.0588	85.8902	95.3210	106.9251	116.4449	120.0431	(72)
Total internal gains	863.4885	857.5504	823.3350	766.0566	706.0891	658.6605	631.7372	643.0764	680.1747	736.1926	794.9719	839.4763	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					1.8900	10.6334	0.6300	0.7000			0.7700			6.1419 (74)
East					21.3700	19.6403	0.6300	0.7000			0.7700			128.2696 (76)
South					2.4900	46.7521	0.6300	0.7000			0.7700			35.5772 (78)
West					11.4300	19.6403	0.6300	0.7000			0.7700			68.6065 (80)
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294			197.7635 (83)
Total gains	1102.0838	1312.6856	1551.7575	1807.0045	1970.3131	1949.4809	1861.9050	1706.1605	1519.3542	1270.0012	1090.2013			1037.2398 (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	53.9770	54.1301	54.2811	55.0014	55.1383	55.7846	55.7846	55.9060	55.5339	55.1383	54.8620	54.5762
alpha	4.5985	4.6087	4.6187	4.6668	4.6759	4.7190	4.7190	4.7271	4.7023	4.6759	4.6575	4.6384
util living area	0.9983	0.9958	0.9874	0.9563	0.8716	0.7100	0.5448	0.6091	0.8562	0.9788	0.9964	0.9987 (86)
MIT	19.8605	19.9917	20.2171	20.5123	20.7544	20.8930	20.9312	20.9240	20.8169	20.4872	20.1206	19.8426 (87)
Th 2	19.8514	19.8542	19.8570	19.8703	19.8727	19.8843	19.8843	19.8864	19.8798	19.8727	19.8677	19.8625 (88)
util rest of house	0.9977	0.9943	0.9828	0.9394	0.8227	0.6128	0.4151	0.4762	0.7826	0.9677	0.9949	0.9982 (89)
MIT 2	18.8132	18.9463	19.1722	19.4699	19.6903	19.8047	19.8241	19.8239	19.7531	19.4528	19.0866	18.8046 (90)
Living area fraction												fLA = Living area / (4) = 0.1369 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT	18.9566	19.0894	19.3153	19.6126	19.8360	19.9537	19.9756	19.9745	19.8987	19.5944	19.2282	18.9467 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9566	19.0894	19.3153	19.6126	19.8360	19.9537	19.9756	19.9745	19.8987	19.5944	19.2282	18.9467 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9930	0.9799	0.9346	0.8208	0.6194	0.4262	0.4874	0.7841	0.9640	0.9937	0.9977	(94)
Useful gains	1098.7695	1303.4475	1520.5117	1688.7742	1617.2064	1207.5514	793.4648	831.6303	1191.3695	1224.2446	1083.3294	1034.8883	(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	3599.3344	3474.7406	3129.5131	2581.7897	1955.9390	1272.1400	802.1187	847.5354	1384.1212	2162.3158	2930.3665	3581.7111	(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	1860.4203	1459.1090	1197.0970	642.9712	252.0171	0.0000	0.0000	0.0000	0.0000	697.9250	1329.8667	1894.8361	(98)
Space heating												9334.2424	(98)
Space heating per m2										(98) / (4) =		48.9011	(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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													84.0000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													10000.9740 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1860.4203	1459.1090	1197.0970	642.9712	252.0171	0.0000	0.0000	0.0000	0.0000	697.9250	1329.8667	1894.8361	(98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)
Space heating fuel (main heating system)	1993.3074	1563.3311	1282.6040	688.8977	270.0183	0.0000	0.0000	0.0000	0.0000	747.7768	1424.8572	2030.1816	(211)
Water heating requirement	286.2185	224.4783	184.1688	98.9186	38.7719	0.0000	0.0000	0.0000	0.0000	107.3731	204.5949	291.5133	(215)
Water heating													
Water heating requirement	186.5075	142.3572	117.3924	64.0445	29.0903	12.3364	6.7792	38.9537	69.6306	122.3331	161.4131	185.6086	(64)
Efficiency of water heater (217)m	82.8775	82.9043	82.8993	82.8839	82.7291	74.0000	74.0000	74.0000	74.0000	82.1895	82.6724	82.9004	(216)
Fuel for water heating, kWh/month	225.0399	171.7127	141.6085	77.2702	35.1633	16.6708	9.1610	52.6402	94.0954	148.8427	195.2443	223.8935	(219)
Water heating fuel used												1391.3424	(219)
Annual totals kWh/year													
Space heating fuel - main system												10000.9740	(211)
Space heating fuel - secondary												1436.0373	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													80.0000 (231)
Electricity for lighting (calculated in Appendix L)													576.1345 (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)
Wind generation												-3575.5408	(234)
Total delivered energy for all uses												8181.7081	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	10000.9740	3.4800	348.0339	(240)
Space heating - secondary	1436.0373	4.2300	60.7444	(242)
Water heating (other fuel)	1391.3424	3.4800	48.4187	(247)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	576.1345	13.1900	75.9921	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Wind Turbine	-3575.5408	13.1900	-471.6138	(252)
Total energy cost			-35.6956	(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] =	-0.0636 (257)
SAP value		100.8866
SAP rating (Section 12)		101 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP band

A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	10000.9740	0.2160	2160.2104 (261)
Space heating - secondary	1436.0373	0.0190	27.2847 (263)
Water heating (other fuel)	1391.3424	0.2160	300.5300 (264)
Space and water heating			2488.0251 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			76.4160 (272)
CO2 emissions per m2			0.4000 (273)
EI value			99.5659
EI rating			100 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
Effective ac	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							35.4385 (36)
Total fabric heat loss						(33) + (36) =	151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	239.8212	238.6932	238.6932	237.1045	237.1045	235.1787	235.6395	234.7317	235.1787	236.1141	236.1141	237.6203 (39)
Average = Sum(39)m / 12 =												236.8328 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2564	1.2505	1.2505	1.2422	1.2422	1.2321	1.2345	1.2297	1.2321	1.2370	1.2370	1.2449 (40)
HLP (average)												1.2407 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	19.2942	17.4270	19.2942	18.6718	19.2942	18.6718	19.2942	19.2942	18.6718	19.2942	18.6718	19.2942 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	214.1881	188.5482	196.0609	169.4758	159.3418	140.3943	133.1448	149.3600	156.1008	181.3821	194.2463	208.7725 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1570 (H8)
Utilisation factor												0.5786 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												115.5000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												1.0978 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-974.5385 (H17)
Solar input	-29.9958	-45.0836	-75.9266	-104.9538	-126.3996	-133.0301	-129.8358	-115.9441	-90.4948	-61.5619	-36.4607	-24.8517 (63)
Solar input (sum of months) = Sum(63)m =												-974.5385 (63)
Output from w/h	184.1923	143.4646	120.1343	64.5221	32.9422	7.3642	3.3090	33.4159	65.6060	119.8202	157.7856	183.9208 (64)
Total per year (kWh/year) = Sum(64)m =												1116.4770 (64)
Heat gains from water heating, kWh/month	91.1127	80.6621	84.4330	72.4468	66.8950	60.0409	58.0758	63.9023	68.6311	79.5523	83.8403	89.3121 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	122.4634	120.0330	113.4852	100.6206	89.9126	83.3901	78.0588	85.8902	95.3210	106.9251	116.4449	120.0431	(72)
Total internal gains	863.4885	857.5504	823.3350	766.0566	706.0891	658.6605	631.7372	643.0764	680.1747	736.1926	794.9719	839.4763	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.8900	11.9814		0.6300		0.7000		0.7700		6.9206 (74)
East				21.3700	22.3313		0.6300		0.7000		0.7700		145.8447 (76)
South				2.4900	50.9848		0.6300		0.7000		0.7700		38.7982 (78)
West				11.4300	22.3313		0.6300		0.7000		0.7700		78.0068 (80)

Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867		221.2284 (83)
Total gains	1133.0588	1320.4809	1554.9561	1842.2459	1978.2645	2048.2773	1941.9199	1801.7250	1593.4070	1315.9047	1136.7587	1060.7047	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2727	55.5339	55.5339	55.9060	55.9060	56.3637	56.2535	56.4711	56.3637	56.1405	56.1405	55.7846	
alpha	4.6848	4.7023	4.7023	4.7271	4.7271	4.7576	4.7502	4.7647	4.7576	4.7427	4.7427	4.7190	
util living area	0.9976	0.9948	0.9834	0.9361	0.8076	0.5559	0.3739	0.4131	0.7566	0.9641	0.9943	0.9982	(86)
MIT	19.9710	20.0863	20.3201	20.6134	20.8341	20.9295	20.9413	20.9406	20.8854	20.5974	20.2384	19.9561	(87)
Th 2	19.8751	19.8798	19.8798	19.8864	19.8864	19.8944	19.8925	19.8963	19.8944	19.8905	19.8905	19.8843	(88)
util rest of house	0.9967	0.9929	0.9770	0.9111	0.7381	0.4417	0.2416	0.2727	0.6506	0.9445	0.9918	0.9975	(89)
MIT 2	18.9434	19.0621	19.2932	19.5789	19.7664	19.8334	19.8353	19.8391	19.8129	19.5737	19.2230	18.9363	(90)
Living area fraction													fLA = Living area / (4) = 0.1369 (91)

MIT	19.0841	19.2023	19.4338	19.7205	19.9126	19.9834	19.9867	19.9899	19.9597	19.7139	19.3620	19.0759 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0841	19.2023	19.4338	19.7205	19.9126	19.9834	19.9867	19.9899	19.9597	19.7139	19.3620	19.0759 (93)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	8445.8588	0.2160	1824.3055 (261)
Space heating - secondary	1212.7387	0.0190	23.0420 (263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Water heating (other fuel)	1368.0019	0.2160	295.4884 (264)
Space and water heating			2142.8360 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-319.0748 (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	8445.8588	1.2200	10303.9477 (261)
Space heating - secondary	1212.7387	1.0400	1261.2482 (263)
Water heating (other fuel)	1368.0019	1.2200	1668.9624 (264)
Space and water heating			13234.1584 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	576.1345	3.0700	1768.7328 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Wind Turbine	-3575.5408	3.0700	-10976.9101 (269)
Primary energy kWh/year			-1328.5890 (272)
Primary energy kWh/m2/year			-6.9603 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0669 V2			Issued on Date	16/07/2019
Assessment Reference	Rev B	Prop Type Ref			
Property					
SAP Rating	90 B	DER	11.41	TER	15.85
Environmental	89 B	% DER<TER	28.01		
CO ₂ Emissions (t/year)	1.54	DFEE	55.68	TFEE	61.71
General Requirements Compliance	Fail	% DFEE<TFEE	9.77		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com			Assessor ID	E477-0001
Client	HJ Concepts, HJC				

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

Detached House, total floor area 191 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) 15.85 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.41 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)55.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (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
Post 98 Regular condens. with auto ign.

SAP default data

Fail

Secondary heating system: Room heaters - Wood Logs

Closed room heater

Efficiency: 65%
Minimum: 65% OK

5 Cylinder insulation

Hot water storage Nominal cylinder loss: 1.79 kWh/day
Permitted by DBSCG 2.30 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK
Independent timer for DHW OK

Boiler interlock

Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
Based on:

Overshading: Average
Windows facing North: 1.89 m², No overhang
Windows facing East: 21.37 m², No overhang
Windows facing South: 2.49 m², No overhang
Windows facing West: 11.43 m², Overhang twice as wide as window, ratio 1.88
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Window U-value 1.10 W/m²K
Secondary heating (wood logs)
Secondary heating fuel: wood logs
Photovoltaic array 2.50 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																6 * 10 =	60.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000	/ (5) =	0.1297 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3797 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3797	(21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	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)				
	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462	(22b)				
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	245.5778	244.8831	244.2022	241.0041	240.4058	237.6203	237.6203	237.1045	238.6932	240.4058	241.6162	242.8817 (39)
Average = Sum(39)m / 12 =												241.0012 (39)
HLP	1.2866	1.2829	1.2793	1.2626	1.2595	1.2449	1.2449	1.2422	1.2505	1.2595	1.2658	1.2724 (40)
HLP (average)												1.2626 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	Jan 115.7349	Feb 111.5263	Mar 107.3178	Apr 103.1092	May 98.9007	Jun 94.6922	Jul 94.6922	Aug 98.9007	Sep 103.1092	Oct 107.3178	Nov 111.5263	Dec 115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (65)
Total per year (kWh/year) = Sum(64)m = 2282.6956 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	599.7562	597.4377	577.5059	544.7514	510.3333	478.0559	457.6459	464.3649	481.6767	514.6716	552.6540	582.2573 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.8900	10.6334	0.6300	0.7000	0.7700		6.1419 (74)	
East					21.3700	19.6403	0.6300	0.7000	0.7700		128.2696 (76)	
South					2.4900	46.7521	0.6300	0.7000	0.7700		35.5772 (78)	
West					11.4300	19.6403	0.6300	0.7000	0.7700		68.6065 (80)	

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	838.3514	1052.5730	1305.9284	1585.6993	1774.5573	1768.8763	1687.8137	1527.4491	1320.8562	1048.4801	847.8834	780.0208 (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	53.9770	54.1301	54.2811	55.0014	55.1383	55.7846	55.7846	55.9060	55.5339	55.1383	54.8620	54.5762
alpha	4.5985	4.6087	4.6187	4.6668	4.6759	4.7190	4.7190	4.7271	4.7023	4.6759	4.6575	4.6384
util living area	0.9995	0.9983	0.9937	0.9726	0.9041	0.7576	0.5932	0.6654	0.9020	0.9899	0.9988	0.9996 (86)
MIT	19.7661	19.8993	20.1326	20.4451	20.7136	20.8770	20.9264	20.9157	20.7772	20.4130	20.0341	19.7501 (87)
Th 2	19.8514	19.8542	19.8570	19.8703	19.8727	19.8843	19.8843	19.8864	19.8798	19.8727	19.8677	19.8625 (88)
util rest of house	0.9993	0.9977	0.9912	0.9610	0.8630	0.6623	0.4558	0.5271	0.8421	0.9842	0.9982	0.9995 (89)
MIT 2	18.1928	18.3898	18.7322	19.1920	19.5582	19.7554	19.7942	19.7910	19.6535	19.1533	18.5976	18.1779 (90)
Living area fraction	18.4082	18.5965	18.9239	19.3635	19.7163	19.9089	19.9492	19.9450	19.8073	19.3258	18.7942	18.3931 (92)
MIT	18.4082	18.5965	18.9239	19.3635	19.7163	19.9089	19.9492	19.9450	19.8073	19.3258	18.7942	18.3931 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4082	18.5965	18.9239	19.3635	19.7163	19.9089	19.9492	19.9450	19.8073	19.3258	18.7942	18.3931 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	837.4192	1049.1078	1290.6381	1512.9088	1519.0236	1175.6864	783.5584	817.3153	1105.7155	1027.5907	845.7000	779.4080 (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	3464.6572	3354.0299	3033.9529	2521.7556	1927.1739	1261.5109	795.8338	840.5236	1362.2954	2097.7274	2825.5201	3447.2467 (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	1954.6651	1548.9077	1297.0262	726.3696	303.6639	0.0000	0.0000	0.0000	0.0000	796.1817	1425.4704	1984.8720 (98)

$$(98) / (4) = \frac{10037.1566}{52.5836} \begin{matrix} (98) \\ (99) \end{matrix}$$

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)	0.1000	(201)
Fraction of space heat from main system(s)	0.9000	(202)
Efficiency of main space heating system 1 (in %)	84.0000	(206)
Efficiency of secondary/supplementary heating system, %	65.0000	(208)
Space heating requirement	10754.0963	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1954.6651	1548.9077	1297.0262	726.3696	303.6639	0.0000	0.0000	0.0000	0.0000	796.1817	1425.4704	1984.8720 (98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000 (210)
Space heating fuel (main heating system)	2094.2840	1659.5439	1389.6709	778.2532	325.3541	0.0000	0.0000	0.0000	0.0000	853.0518	1527.2898	2126.6486 (211)
Water heating requirement	300.7177	238.2935	199.5425	111.7492	46.7175	0.0000	0.0000	0.0000	0.0000	122.4895	219.3031	305.3649 (215)

Water heating													
Water heating requirement													
	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater												74.0000	(216)
(217)m	82.7327	82.6102	82.3165	81.5528	79.6835	74.0000	74.0000	74.0000	74.0000	81.6539	82.4671	82.7760	(217)
Fuel for water heating, kWh/month													
	271.8479	239.9582	252.8968	228.8121	229.4768	220.7761	212.0145	232.6695	232.2661	236.9720	248.1227	265.1633	(219)
Water heating fuel used												2870.9759	(219)
Annual totals kWh/year													
Space heating fuel - main system												10754.0963	(211)
Space heating fuel - secondary												1544.1779	(215)

Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
Total electricity for the above, kWh/year	30.0000 (231)
Electricity for lighting (calculated in Appendix L)	576.1345 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 2.50 * 1068 * 1.00) =	-2136.1410	-2136.1410 (233)
Total delivered energy for all uses		13639.2437 (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	10754.0963	0.2160	2322.8848	(261)
Space heating - secondary	1544.1779	0.0190	29.3394	(263)
Water heating (other fuel)	2870.9759	0.2160	620.1308	(264)
Space and water heating			2972.3550	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Energy saving/generation technologies				
PV Unit	-2136.1410	0.5190	-1108.6572	(269)
Total CO2, kg/year			2178.2816	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.4100	(273)

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

Total Floor Area		11.4100	ZC1
Assumed number of occupants	TFA	190.8800	
CO ₂ emission factor in Table 12 for electricity displaced from grid	N	2.9900	
CO ₂ emissions from appliances, equation (L14)	EF	0.5190	
CO ₂ emissions from cooking, equation (L16)		11.2472	ZC2
Total CO ₂ emissions		0.9994	ZC3
Residual CO ₂ emissions offset from biofuel CHP		23.6566	ZC4
Additional allowable electricity generation, kWh/m ² /year		0.0000	ZC5
Resulting CO ₂ emissions offset from additional allowable electricity generation		0.0000	ZC6
Net CO ₂ emissions		0.0000	ZC7
		23.6566	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (Uw = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (56)												
If cylinder contains dedicated solar storage												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
223.3780 196.8488 206.6466 185.1230 181.3261 161.8946 155.3617 170.6464 170.3972 191.9678 203.1398 217.9625 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625 (64)
Total per year (kWh/year) = Sum(64)m =												2264.6926 (64)
Heat gains from water heating, kWh/month												
98.4647 87.3026 92.9015 84.9645 84.4824 77.2411 75.8493 80.9315 80.0682 88.0208 90.9551 96.6641 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
32.6231 28.9756 23.5645 17.8399 13.3355 11.2584 12.1651 15.8126 21.2237 26.9484 31.4527 33.5298 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
362.2933 366.0527 356.5790 336.4105 310.9514 287.0235 271.0381 267.2787 276.7524 296.9209 322.3800 346.3079 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 (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)													
-119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 (71)													
Water heating gains (Table 5)													
132.3451 129.9147 124.8677 118.0063 113.5517 107.2793 101.9480 108.7789 111.2059 118.3076 126.3266 129.9248 (72)													
Total internal gains	598.1121	595.7936	575.8618	543.1073	508.6892	476.4118	456.0018	462.7208	480.0326	513.0274	551.0099	580.6132 (73)	

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)
East	21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)
South	2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)
West	11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	836.7073	1050.9289	1304.2843	1584.0552	1772.9132	1767.2322	1686.1696	1525.8050	1319.2121	1046.8360	846.2392	778.3767 (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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001	
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000	
util living area	0.9995	0.9984	0.9936	0.9710	0.8970	0.7427	0.5757	0.6486	0.8949	0.9897	0.9988	0.9997 (86)	
MIT	19.5049	19.6800	19.9848	20.3878	20.7301	20.9271	20.9832	20.9711	20.8044	20.3367	19.8455	19.4795 (87)	
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054 (88)	
util rest of house													
0.9993 0.9978 0.9911 0.9591 0.8547 0.6489 0.4450 0.5155 0.8338 0.9838 0.9983 0.9995 (89)													
MIT 2	17.8906	18.1483	18.5943	19.1807	19.6434	19.8733	19.9165	19.9121	19.7520	19.1164	18.3982	17.8595 (90)	
Living area fraction													
MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (91)	
Temperature adjustment												0.0000	
adjusted MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9988 0.9965 0.9873 0.9507 0.8490 0.6580 0.4627 0.5331 0.8322 0.9787 0.9973 0.9992 (94)													
Useful gains	835.7296	1047.2189	1287.7359	1505.9743	1505.2837	1162.8179	780.2572	813.4162	1097.8307	1024.5788	843.9235	777.7367 (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													
3241.1589 3150.8497 2869.5702 2413.8371 1866.1266 1237.4841 790.9136 833.8799 1328.8209 2002.4784 2662.0772 3228.1329 (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	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948 (98)	
Space heating												9162.0152 (98)	
Space heating per m2												47.9988 (99)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													9798.9467 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1914.0529	1511.9144	1258.7002	699.1029	287.1306	0.0000	0.0000	0.0000	0.0000	778.1361	1400.0756	1949.8340	(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	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625	(64)
Efficiency of water heater (217)m	89.1732	89.0407	88.7231	87.8988	85.8590	79.8000	79.8000	79.8000	79.8000	88.0356	88.8987	89.2224	(216)
Fuel for water heating, kWh/month	250.4991	221.0774	232.9118	210.6092	211.1906	202.8754	194.6888	213.8427	213.5304	218.0569	228.5069	244.2911	(219)
Water heating fuel used												2642.0803	(219)
Annual totals kWh/year													
Space heating fuel - main system												9798.9467	(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)												576.1345	(232)
Total delivered energy for all uses												13092.1615	(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	9798.9467	0.2160	2116.5725 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2642.0803	0.2160	570.6893 (264)
Space and water heating			2687.2618 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total CO2, kg/m2/year			3025.2006 (272)
Emissions per m2 for space and water heating			14.0783 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.5665 (272b)
Emissions per m2 for pumps and fans			0.2039 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0783 * 1.00) + 1.5665 + 0.2039, rounded to 2 d.p.			15.8500 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.0865 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3365 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3365	(21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954	(22b)				
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	241.7357	241.1902	240.6556	238.1444	237.6745	235.4873	235.4873	235.0823	236.3298	237.6745	238.6250	239.6187 (39)
Average = Sum(39)m / 12 =												238.1421 (39)
HLP	1.2664	1.2636	1.2608	1.2476	1.2452	1.2337	1.2337	1.2316	1.2381	1.2452	1.2501	1.2553 (40)
HLP (average)												1.2476 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)		
East					21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)		
South					2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)		
West					11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)		

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262 (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	54.8349	54.9589	55.0810	55.6618	55.7719	56.2899	56.2899	56.3869	56.0892	55.7719	55.5497	55.3194	
alpha	4.6557	4.6639	4.6721	4.7108	4.7181	4.7527	4.7527	4.7591	4.7393	4.7181	4.7033	4.6880	
util living area	0.9997	0.9989	0.9952	0.9772	0.9149	0.7758	0.6126	0.6889	0.9173	0.9927	0.9992	0.9998	(86)
MIT	19.4164	19.5930	19.9029	20.3169	20.6803	20.9050	20.9761	20.9594	20.7614	20.2681	19.7652	19.3911	(87)
Th 2	19.8672	19.8695	19.8717	19.8821	19.8840	19.8931	19.8931	19.8948	19.8896	19.8840	19.8801	19.8760	(88)
util rest of house	0.9996	0.9984	0.9933	0.9673	0.8770	0.6825	0.4736	0.5502	0.8636	0.9885	0.9989	0.9997	(89)
MIT 2	18.4155	18.5937	18.9045	19.3206	19.6616	19.8480	19.8870	19.8827	19.7459	19.2785	18.7743	18.3971	(90)
Living area fraction									fLA = Living area / (4) =			0.1369	(91)
MIT	18.5525	18.7305	19.0411	19.4570	19.8010	19.9927	20.0361	20.0301	19.8849	19.4140	18.9100	18.5331	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5525	18.7305	19.0411	19.4570	19.8010	19.9927	20.0361	20.0301	19.8849	19.4140	18.9100	18.5331	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9994	0.9978	0.9913	0.9624	0.8736	0.6919	0.4927	0.5688	0.8633	0.9859	0.9984	0.9996	(94)
Ext temp.	749.8971	963.3665	1210.0099	1446.3614	1479.3211	1169.3014	793.5901	823.6632	1070.9747	951.9441	760.9015	692.6215	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3445.3454	3335.7900	3018.0956	2514.0874	1925.4094	1269.9084	809.1577	853.3788	1367.1380	2094.8551	2818.1576	3434.4847	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	2005.4136	1594.2686	1345.2158	768.7628	331.8897	0.0000	0.0000	0.0000	0.0000	850.3258	1481.2244	2039.9462	(98)
Space heating per m2												10417.0468	(98)
												(98) / (4) =	54.5738 (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	2213.5807	1742.6061	1786.6253	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8066	0.8808	0.8363	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1785.5351	1534.9229	1494.1159	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	236.5114	359.5070	250.4275	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												846.4458 (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	59.1278	89.8767	62.6069	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												211.6115 (107)
Space cooling per m2												1.1086 (108)
Energy for space heating												54.5738 (99)
Energy for space cooling												1.1086 (108)
Total												55.6824 (109)
Dwelling Fabric Energy Efficiency (DFEE)												55.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (Uw = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North				1.8900	10.6334		0.6300	0.7000	0.7700	6.1419 (74)		
East				21.3700	19.6403		0.6300	0.7000	0.7700	128.2696 (76)		
South				2.4900	46.7521		0.6300	0.7000	0.7700	35.5772 (78)		
West				11.4300	19.6403		0.6300	0.7000	0.7700	68.6065 (80)		
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262 (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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001	
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000	
util living area	0.9997	0.9989	0.9951	0.9762	0.9102	0.7645	0.5988	0.6756	0.9127	0.9926	0.9993	0.9998	(86)
MIT	19.4631	19.6389	19.9453	20.3533	20.7062	20.9171	20.9802	20.9655	20.7808	20.2990	19.8048	19.4380	(87)
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054	(88)
util rest of house	0.9996	0.9985	0.9932	0.9661	0.8714	0.6719	0.4647	0.5405	0.8579	0.9883	0.9989	0.9997	(89)
MIT 2	18.4852	18.6626	18.9699	19.3799	19.7098	19.8835	19.9176	19.9141	19.7876	19.3324	18.8370	18.4671	(90)
Living area fraction									fLA = Living area / (4) =			0.1369	(91)
MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9994	0.9979	0.9913	0.9613	0.8685	0.6817	0.4831	0.5588	0.8582	0.9858	0.9985	0.9996	(94)
Ext temp.	749.9234	963.4251	1209.9958	1444.7370	1470.7292	1152.1055	778.2149	809.1015	1064.5675	951.8191	760.9442	692.6405	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3360.2576	3253.4532	2944.0321	2452.4675	1878.5794	1239.1841	791.0345	834.1019	1335.1239	2044.2913	2748.4918	3348.7675	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1942.0886	1538.8989	1290.1230	725.5659	303.4405	0.0000	0.0000	0.0000	0.0000	812.7993	1431.0343	1976.1585	(98)
Space heating per m2												10020.1090	(98)
												(98) / (4) =	52.4943 (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	2147.1638	1690.3204	1732.9265	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8231	0.8940	0.8517	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1767.3076	1511.1832	1476.0148	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	249.6352	377.1693	263.8947	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												890.6992 (104)
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	62.4088	94.2923	65.9737	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												222.6748 (107)
Space cooling per m2												1.1666 (108)
Energy for space heating												52.4943 (99)
Energy for space cooling												1.1666 (108)
Total												53.6609 (109)
Target Fabric Energy Efficiency (TFEE)												61.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
Effective ac	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	239.8212	238.6932	238.6932	237.1045	237.1045	235.1787	235.6395	234.7317	235.1787	236.1141	236.1141	237.6203 (39)
Average = Sum(39)m / 12 =												236.8328 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2564	1.2505	1.2505	1.2422	1.2422	1.2321	1.2345	1.2297	1.2321	1.2370	1.2370	1.2449 (40)
HLP (average)												1.2407 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
RHI water heating demand												2283 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]				Area	Solar flux	g			FF	Access		Gains
				m2	Table 6a	Specific data				factor		W
					W/m2	or Table 6b				Table 6c		
North				1.8900		11.9814		0.6300	0.7000		0.7700	6.9206 (74)
East				21.3700		22.3313		0.6300	0.7000		0.7700	145.8447 (76)
South				2.4900		50.9848		0.6300	0.7000		0.7700	38.7982 (78)
West				11.4300		22.3313		0.6300	0.7000		0.7700	78.0068 (80)

Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284 (83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305 (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	55.2727	55.5339	55.5339	55.9060	55.9060	56.3637	56.2535	56.4711	56.3637	56.1405	56.1405	55.7846
alpha	4.6848	4.7023	4.7023	4.7271	4.7271	4.7576	4.7502	4.7647	4.7576	4.7427	4.7427	4.7190
util living area	0.9975	0.9946	0.9828	0.9340	0.8021	0.5499	0.3692	0.4078	0.7513	0.9628	0.9941	0.9981 (86)
MIT	19.9751	20.0904	20.3244	20.6184	20.8374	20.9301	20.9414	20.9407	20.8871	20.6014	20.2425	19.9602 (87)
Th 2	19.8751	19.8798	19.8798	19.8864	19.8864	19.8944	19.8925	19.8963	19.8944	19.8905	19.8905	19.8843 (88)
util rest of house	0.9966	0.9926	0.9762	0.9083	0.7319	0.4365	0.2384	0.2691	0.6450	0.9426	0.9914	0.9974 (89)
MIT 2	18.5165	18.6880	19.0267	19.4425	19.7139	19.8053	19.8087	19.8125	19.7764	19.4318	18.9188	18.5019 (90)
Living area fraction									fLA = Living area / (4) =			0.1369 (91)
MIT	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9952	0.9901	0.9708	0.9002	0.7306	0.4435	0.2469	0.2781	0.6487	0.9353	0.9887	0.9963 (94)
Useful gains	1139.0973	1318.8140	1522.1731	1675.5928	1463.7266	919.6548	485.8195	507.8295	1045.0379	1242.9320	1135.2905	1068.2972 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	3265.4391	3169.8460	2817.6273	2300.7270	1628.3727	931.1372	486.2985	508.6610	1112.0215	1887.0000	2620.8591	3231.9932 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	1581.9983	1243.8935	963.8179	450.0966	122.4967	0.0000	0.0000	0.0000	0.0000	479.1866	1069.6094	1609.7899 (98)
Space heating												7520.8888 (98)
RHI space heating demand												7521 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																6 * 10 =	60.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000 / (5) =	0.1297 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.3797 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3797 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	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)				
	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462	(22b)				
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	245.5778	244.8831	244.2022	241.0041	240.4058	237.6203	237.6203	237.1045	238.6932	240.4058	241.6162	242.8817 (39)
Average = Sum(39)m / 12 =												241.0012 (39)
HLP	1.2866	1.2829	1.2793	1.2626	1.2595	1.2449	1.2449	1.2422	1.2505	1.2595	1.2658	1.2724 (40)
HLP (average)												1.2626 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.8900	10.6334	0.6300	0.7000	0.7700		6.1419 (74)	
East					21.3700	19.6403	0.6300	0.7000	0.7700		128.2696 (76)	
South					2.4900	46.7521	0.6300	0.7000	0.7700		35.5772 (78)	
West					11.4300	19.6403	0.6300	0.7000	0.7700		68.6065 (80)	
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	1113.6096	1324.2114	1564.7841	1826.0343	1995.5962	1975.0142	1887.4383	1730.6933	1536.8832	1283.0278	1101.7271	1048.7656 (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	53.9770	54.1301	54.2811	55.0014	55.1383	55.7846	55.7846	55.9060	55.5339	55.1383	54.8620	54.5762
alpha	4.5985	4.6087	4.6187	4.6668	4.6759	4.7190	4.7190	4.7271	4.7023	4.6759	4.6575	4.6384
util living area	0.9982	0.9956	0.9870	0.9547	0.8672	0.7035	0.5382	0.6019	0.8519	0.9780	0.9963	0.9986 (86)
MIT	19.8646	19.9957	20.2216	20.5178	20.7592	20.8949	20.9318	20.9249	20.8200	20.4914	20.1247	19.8467 (87)
Th 2	19.8514	19.8542	19.8570	19.8703	19.8727	19.8843	19.8843	19.8864	19.8798	19.8727	19.8677	19.8625 (88)
util rest of house	0.9975	0.9941	0.9822	0.9373	0.8173	0.6062	0.4097	0.4699	0.7774	0.9665	0.9947	0.9982 (89)
MIT 2	18.3369	18.5303	18.8603	19.2914	19.6110	19.7691	19.7963	19.7953	19.6972	19.2636	18.7296	18.3192 (90)
Living area fraction	18.5460	18.7309	19.0466	19.4593	19.7682	19.9232	19.9518	19.9499	19.8509	19.4317	18.9206	18.5283 (92)
MIT	18.5460	18.7309	19.0466	19.4593	19.7682	19.9232	19.9518	19.9499	19.8509	19.4317	18.9206	18.5283 (93)
Temperature adjustment												0.0000
adjusted MIT	18.5460	18.7309	19.0466	19.4593	19.7682	19.9232	19.9518	19.9499	19.8509	19.4317	18.9206	18.5283 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1109.6749	1313.5165	1529.6089	1696.7400	1620.2229	1204.6502	788.5380	827.1504	1191.1881	1231.9316	1093.6799	1045.9522 (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	3498.5012	3386.9559	3063.9191	2544.8303	1939.6324	1264.9074	796.4441	841.7062	1372.7094	2123.1897	2856.0549	3480.0736 (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	1777.2868	1393.3513	1141.5268	610.6251	237.6407	0.0000	0.0000	0.0000	0.0000	663.0960	1268.9100	1810.9864 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 8903.4230 (98)
46.6441 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													84.0000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													9539.3818 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1777.2868	1393.3513	1141.5268	610.6251	237.6407	0.0000	0.0000	0.0000	0.0000	663.0960	1268.9100	1810.9864	(98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)
Space heating fuel (main heating system)	1904.2359	1492.8764	1223.0644	654.2411	254.6150	0.0000	0.0000	0.0000	0.0000	710.4600	1359.5464	1940.3425	(211)
Water heating requirement	273.4287	214.3617	175.6195	93.9423	36.5601	0.0000	0.0000	0.0000	0.0000	102.0148	195.2169	278.6133	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	82.6236	82.4786	82.1300	81.2180	79.0749	74.0000	74.0000	74.0000	74.0000	81.3097	82.3099	82.6740	(216)
Fuel for water heating, kWh/month	272.2068	240.3409	253.4709	229.7554	231.2430	220.7761	212.0145	232.6695	232.2661	237.9751	248.5965	265.4902	(217)
Water heating fuel used												2876.8050	(219)
Annual totals kWh/year													
Space heating fuel - main system												9539.3818	(211)
Space heating fuel - secondary												1369.7574	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1068 * 1.00) =										-2136.1410		-2136.1410	(233)
Total delivered energy for all uses												12255.9377	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9539.3818	3.4800	331.9705	(240)
Space heating - secondary	1369.7574	4.2300	57.9407	(242)
Water heating (other fuel)	2876.8050	3.4800	100.1128	(247)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Energy for lighting	576.1345	13.1900	75.9921	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-2136.1410	13.1900	-281.7570	(252)
Total energy cost			408.2162	(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] =	0.7269 (257)
SAP value	89.8604	
SAP rating (Section 12)	90	(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	9539.3818	0.2160	2060.5065	(261)
Space heating - secondary	1369.7574	0.0190	26.0254	(263)
Water heating (other fuel)	2876.8050	0.2160	621.3899	(264)
Space and water heating			2707.9217	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Energy saving/generation technologies				
PV Unit	-2136.1410	0.5190	-1108.6572	(269)
Total kg/year			1913.8484	(272)
CO2 emissions per m2			10.0300	(273)
EI value			89.1277	
EI rating			89	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.25) / 0.8400 = 4.443$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.25) / 0.8400 = 0.2758$, stars = 4
Water heating energy efficiency	$3.48 / 0.7915 = 4.397$, stars = 4
Water heating environmental impact	$0.216 / 0.7915 = 0.2729$, stars = 4

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	239.8212	238.6932	238.6932	237.1045	237.1045	235.1787	235.6395	234.7317	235.1787	236.1141	236.1141	237.6203 (39)
Average = Sum(39)m / 12 =												236.8328 (39)
HLP	1.2564	1.2505	1.2505	1.2422	1.2422	1.2321	1.2345	1.2297	1.2321	1.2370	1.2370	1.2449 (40)
HLP (average)												1.2407 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.8900	11.9814	0.6300	0.7000	0.7700	6.9206 (74)		
East					21.3700	22.3313	0.6300	0.7000	0.7700	145.8447 (76)		
South					2.4900	50.9848	0.6300	0.7000	0.7700	38.7982 (78)		
West					11.4300	22.3313	0.6300	0.7000	0.7700	78.0068 (80)		
Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284 (83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305 (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	55.2727	55.5339	55.5339	55.9060	55.9060	56.3637	56.2535	56.4711	56.3637	56.1405	56.1405	55.7846
alpha	4.6848	4.7023	4.7023	4.7271	4.7271	4.7576	4.7502	4.7647	4.7576	4.7427	4.7427	4.7190
util living area	0.9975	0.9946	0.9828	0.9340	0.8021	0.5499	0.3692	0.4078	0.7513	0.9628	0.9941	0.9981 (86)
MIT	19.9751	20.0904	20.3244	20.6184	20.8374	20.9301	20.9414	20.9407	20.8871	20.6014	20.2425	19.9602 (87)
Th 2	19.8751	19.8798	19.8798	19.8864	19.8864	19.8944	19.8925	19.8963	19.8944	19.8905	19.8905	19.8843 (88)
util rest of house	0.9966	0.9926	0.9762	0.9083	0.7319	0.4365	0.2384	0.2691	0.6450	0.9426	0.9914	0.9974 (89)
MIT 2	18.5165	18.6880	19.0267	19.4425	19.7139	19.8053	19.8087	19.8125	19.7764	19.4318	18.9188	18.5019 (90)
Living area fraction	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (91)
MIT	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1139.0973	1318.8140	1522.1731	1675.5928	1463.7266	919.6548	485.8195	507.8295	1045.0379	1242.9320	1135.2905	1068.2972 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	3265.4391	3169.8460	2817.6273	2300.7270	1628.3727	931.1372	486.2985	508.6610	1112.0215	1887.0000	2620.8591	3231.9932 (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	1581.9983	1243.8935	963.8179	450.0966	122.4967	0.0000	0.0000	0.0000	0.0000	479.1866	1069.6094	1609.7899 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating
Space heating per m2 (98) / (4) = 7520.8888 (98)
39.4011 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													84.0000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													8058.0951 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1581.9983	1243.8935	963.8179	450.0966	122.4967	0.0000	0.0000	0.0000	0.0000	479.1866	1069.6094	1609.7899	(98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)
Space heating fuel (main heating system)	1694.9982	1332.7430	1032.6621	482.2464	131.2464	0.0000	0.0000	0.0000	0.0000	513.4142	1146.0101	1724.7748	(211)
Water heating requirement	243.3844	191.3682	148.2797	69.2456	18.8456	0.0000	0.0000	0.0000	0.0000	73.7210	164.5553	247.6600	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	82.4795	82.3264	81.8590	80.5664	77.4689	74.0000	74.0000	74.0000	74.0000	80.6256	82.0562	82.5326	(216)
Fuel for water heating, kWh/month	272.6822	240.7853	254.3099	231.6134	236.0367	220.7761	212.0145	232.6695	232.2661	239.9943	249.3651	265.9451	(219)
Water heating fuel used												2888.4583	(219)
Annual totals kWh/year													
Space heating fuel - main system												8058.0951	(211)
Space heating fuel - secondary												1157.0598	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1121 * 1.00) =										-2241.9563		-2241.9563	(233)
Total delivered energy for all uses												10467.7914	(238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	8058.0951	3.9300	316.6831	(240)
Space heating - secondary	1157.0598	4.6500	53.8033	(242)
Water heating (other fuel)	2888.4583	3.9300	113.5164	(247)
Pumps and fans for heating	30.0000	17.5600	5.2680	(249)
Energy for lighting	576.1345	17.5600	101.1692	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-2241.9563	17.5600	-393.6875	(252)
Total energy cost			284.7525	(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	8058.0951	0.2160	1740.5485	(261)
Space heating - secondary	1157.0598	0.0190	21.9841	(263)
Water heating (other fuel)	2888.4583	0.2160	623.9070	(264)
Space and water heating			2386.4397	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Energy saving/generation technologies				
PV Unit	-2241.9563	0.5190	-1163.5753	(269)
Total kg/year			1537.4481	(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	8058.0951	1.2200	9830.8761	(261)
Space heating - secondary	1157.0598	1.0400	1203.3422	(263)
Water heating (other fuel)	2888.4583	1.2200	3523.9191	(264)
Space and water heating			14558.1374	(265)
Pumps and fans	30.0000	3.0700	92.1000	(267)
Energy for lighting	576.1345	3.0700	1768.7328	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy saving/generation technologies			
PV Unit	-2241.9563	3.0700	-6882.8059 (269)
Primary energy kWh/year			9536.1644 (272)
Primary energy kWh/m2/year			49.9589 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 90
Current environmental impact rating:	B 89

(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	Already installed
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	Recommended
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 48	-290 kg (18.8%)
V2 Wind turbine	+ 11.7	-£ 628	-1856 kg (148.7%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£48	1.52 kg/m²	B 91 B 91
Wind turbine	£628	9.72 kg/m²	A 103 A 101
Total Savings	£676	11.24 kg/m²	

Potential energy efficiency rating:	A 103
Potential environmental impact rating:	A 101

Fuel prices for cost data on this page from database revision number 445 TEST (30 Jul 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£106	£115	-£9
Mains gas	£518	£461	£57
Wood	£54	£54	-£0
Space heating	£464	£466	-£2
Water heating	£114	£63	£51
Lighting	£101	£101	£0
Generated (PV)	-£394	-£394	£0
Generated (wind)	-£0	-£628	£628
Total cost of fuels	£284	-£392	£676
Total cost of uses	£285	-£392	£676
Delivered energy	55 kWh/m²	29 kWh/m²	26 kWh/m²
Carbon dioxide emissions	1.5 tonnes	-0.6 tonnes	2.1 tonnes
CO2 emissions per m²	8 kg/m²	-3 kg/m²	11 kg/m²
Primary energy	50 kWh/m²	-16 kWh/m²	66 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	245.5778	244.8831	244.2022	241.0041	240.4058	237.6203	237.6203	237.1045	238.6932	240.4058	241.6162	242.8817 (39)
Average = Sum(39)m / 12 =												241.0012 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2866	1.2829	1.2793	1.2626	1.2595	1.2449	1.2449	1.2422	1.2505	1.2595	1.2658	1.2724 (40)
HLP (average)												1.2626 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage												
19.2942	17.4270	19.2942	18.6718	19.2942	18.6718	19.2942	19.2942	18.6718	19.2942	18.6718	19.2942	19.2942 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	214.1881	188.5482	196.0609	169.4758	159.3418	140.3943	133.1448	149.3600	156.1008	181.3821	194.2463	208.7725 (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												1.0956 (H8)
Utilisation factor												0.5986 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												115.5000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												1.0978 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-954.5690 (H17)
Solar input	-27.6806	-46.1910	-78.6685	-105.4313	-130.2515	-128.0579	-126.3656	-110.4063	-86.4703	-59.0490	-32.8332	-23.1639 (63)
Solar input (sum of months) = Sum(63)m =												-954.5690 (63)
Output from w/h	186.5075	142.3572	117.3924	64.0445	29.0903	12.3364	6.7792	38.9537	69.6306	122.3331	161.4131	185.6086 (64)
Total per year (kWh/year) = Sum(64)m =												1136.4465 (64)
Heat gains from water heating, kWh/month	91.1127	80.6621	84.4330	72.4468	66.8950	60.0409	58.0758	63.9023	68.6311	79.5523	83.8403	89.3121 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	122.4634	120.0330	113.4852	100.6206	89.9126	83.3901	78.0588	85.8902	95.3210	106.9251	116.4449	120.0431	(72)
Total internal gains	863.4885	857.5504	823.3350	766.0566	706.0891	658.6605	631.7372	643.0764	680.1747	736.1926	794.9719	839.4763	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					1.8900	10.6334	0.6300	0.7000			0.7700			6.1419 (74)
East					21.3700	19.6403	0.6300	0.7000			0.7700			128.2696 (76)
South					2.4900	46.7521	0.6300	0.7000			0.7700			35.5772 (78)
West					11.4300	19.6403	0.6300	0.7000			0.7700			68.6065 (80)
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)		
Total gains	1102.0838	1312.6856	1551.7575	1807.0045	1970.3131	1949.4809	1861.9050	1706.1605	1519.3542	1270.0012	1090.2013	1037.2398 (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	53.9770	54.1301	54.2811	55.0014	55.1383	55.7846	55.7846	55.9060	55.5339	55.1383	54.8620	54.5762
alpha	4.5985	4.6087	4.6187	4.6668	4.6759	4.7190	4.7190	4.7271	4.7023	4.6759	4.6575	4.6384
util living area	0.9983	0.9958	0.9874	0.9563	0.8716	0.7100	0.5448	0.6091	0.8562	0.9788	0.9964	0.9987 (86)
MIT	19.8605	19.9917	20.2171	20.5123	20.7544	20.8930	20.9312	20.9240	20.8169	20.4872	20.1206	19.8426 (87)
Th 2	19.8514	19.8542	19.8570	19.8703	19.8727	19.8843	19.8843	19.8864	19.8798	19.8727	19.8677	19.8625 (88)
util rest of house	0.9977	0.9943	0.9828	0.9394	0.8227	0.6128	0.4151	0.4762	0.7826	0.9677	0.9949	0.9982 (89)
MIT 2	18.3309	18.5244	18.8540	19.2839	19.6056	19.7677	19.7961	19.7949	19.6943	19.2578	18.7237	18.3131 (90)
Living area fraction									fLA = Living area /	(4) =		0.1369 (91)

MIT	18.5403	18.7253	19.0406	19.4521	19.7628	19.9217	19.9515	19.9495	19.8479	19.4261	18.9149	18.5225 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5403	18.7253	19.0406	19.4521	19.7628	19.9217	19.9515	19.9495	19.8479	19.4261	18.9149	18.5225 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP band

A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	9602.0876	0.2160	2074.0509 (261)
Space heating - secondary	1378.7613	0.0190	26.1965 (263)
Water heating (other fuel)	1391.9967	0.2160	300.6713 (264)
Space and water heating			2400.9187 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Energy saving/generation technologies			
PV Unit	-2136.1410	0.5190	-1108.6572 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-222.9103 (272)
CO2 emissions per m2			-1.1700 (273)
EI value			101.2663
EI rating			101 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	239.8212	238.6932	238.6932	237.1045	237.1045	235.1787	235.6395	234.7317	235.1787	236.1141	236.1141	237.6203 (39)
Average = Sum(39)m / 12 =												236.8328 (39)
HLP	1.2564	1.2505	1.2505	1.2422	1.2422	1.2321	1.2345	1.2297	1.2321	1.2370	1.2370	1.2449 (40)
HLP (average)												1.2407 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	19.2942	17.4270	19.2942	18.6718	19.2942	18.6718	19.2942	19.2942	18.6718	19.2942	18.6718	19.2942 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	214.1881	188.5482	196.0609	169.4758	159.3418	140.3943	133.1448	149.3600	156.1008	181.3821	194.2463	208.7725 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1570 (H8)
Utilisation factor												0.5786 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												115.5000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												1.0978 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-974.5385 (H17)
Solar input	-29.9958	-45.0836	-75.9266	-104.9538	-126.3996	-133.0301	-129.8358	-115.9441	-90.4948	-61.5619	-36.4607	-24.8517 (63)
Solar input (sum of months) = Sum(63)m =												-974.5385 (63)
Output from w/h	184.1923	143.4646	120.1343	64.5221	32.9422	7.3642	3.3090	33.4159	65.6060	119.8202	157.7856	183.9208 (64)
Total per year (kWh/year) = Sum(64)m =												1116.4770 (64)
Heat gains from water heating, kWh/month	91.1127	80.6621	84.4330	72.4468	66.8950	60.0409	58.0758	63.9023	68.6311	79.5523	83.8403	89.3121 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	122.4634	120.0330	113.4852	100.6206	89.9126	83.3901	78.0588	85.8902	95.3210	106.9251	116.4449	120.0431	(72)
Total internal gains	863.4885	857.5504	823.3350	766.0566	706.0891	658.6605	631.7372	643.0764	680.1747	736.1926	794.9719	839.4763	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.8900	11.9814		0.6300		0.7000		0.7700		6.9206 (74)
East				21.3700	22.3313		0.6300		0.7000		0.7700		145.8447 (76)
South				2.4900	50.9848		0.6300		0.7000		0.7700		38.7982 (78)
West				11.4300	22.3313		0.6300		0.7000		0.7700		78.0068 (80)

Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284	(83)
Total gains	1133.0588	1320.4809	1554.9561	1842.2459	1978.2645	2048.2773	1941.9199	1801.7250	1593.4070	1315.9047	1136.7587	1060.7047	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2727	55.5339	55.5339	55.9060	55.9060	56.3637	56.2535	56.4711	56.3637	56.1405	56.1405	55.7846	
alpha	4.6848	4.7023	4.7023	4.7271	4.7271	4.7576	4.7502	4.7647	4.7576	4.7427	4.7427	4.7190	
util living area	0.9976	0.9948	0.9834	0.9361	0.8076	0.5559	0.3739	0.4131	0.7566	0.9641	0.9943	0.9982	(86)
MIT	19.9710	20.0863	20.3201	20.6134	20.8341	20.9295	20.9413	20.9406	20.8854	20.5974	20.2384	19.9561	(87)
Th 2	19.8751	19.8798	19.8798	19.8864	19.8864	19.8944	19.8925	19.8963	19.8944	19.8905	19.8905	19.8843	(88)
util rest of house	0.9967	0.9929	0.9770	0.9111	0.7381	0.4417	0.2416	0.2727	0.6506	0.9445	0.9918	0.9975	(89)
MIT 2	18.5105	18.6821	19.0206	19.4360	19.7107	19.8050	19.8087	19.8125	19.7751	19.4266	18.9129	18.4958	(90)
Living area fraction													0.1369 (91)
fLA = Living area / (4) =													

MIT	18.7104	18.8744	19.1985	19.5972	19.8644	19.9589	19.9637	19.9670	19.9271	19.5868	19.0943	18.6957 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7104	18.8744	19.1985	19.5972	19.8644	19.9589	19.9637	19.9670	19.9271	19.5868	19.0943	18.6957 (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

Water heating (other fuel)	1368.7273	0.2160	295.6451 (264)
Space and water heating			2070.7749 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Energy saving/generation technologies			
PV Unit	-2241.9563	0.5190	-1163.5753 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-607.9723 (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	8115.6876	1.2200	9901.1389 (261)
Space heating - secondary	1165.3295	1.0400	1211.9427 (263)
Water heating (other fuel)	1368.7273	1.2200	1669.8473 (264)
Space and water heating			12782.9289 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	576.1345	3.0700	1768.7328 (268)
Energy saving/generation technologies			
PV Unit	-2241.9563	3.0700	-6882.8059 (269)
Wind Turbine	-3575.5408	3.0700	-10976.9101 (269)
Primary energy kWh/year			-3062.4543 (272)
Primary energy kWh/m2/year			-16.0439 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0669 V2			Issued on Date	16/07/2019
Assessment Reference	Rev C	Prop Type Ref			
Property					
SAP Rating	77 C	DER	19.37	TER	23.59
Environmental	81 B	% DER<TER	17.90		
CO ₂ Emissions (t/year)	3.02	DFEE	55.68	TFEE	61.71
General Requirements Compliance	Pass	% DFEE<TFEE	9.77		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com			Assessor ID	E477-0001
Client	HJ Concepts, HJC				

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

Detached House, total floor area 191 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:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 23.59 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 19.37 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)55.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (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: Heat pump with radiators or underfloor - Electric
Air-to-water heat pump

Secondary heating system: Room heaters - Wood Logs

Closed room heater

Efficiency: 65%

Minimum: 65% OK

5 Cylinder insulation

Hot water storage Nominal cylinder loss: 1.79 kWh/day

Permitted by DBSCG 2.30 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North: 1.89 m², No overhang
Windows facing East: 21.37 m², No overhang
Windows facing South: 2.49 m², No overhang
Windows facing West: 11.43 m², Overhang twice as wide as window, ratio 1.88
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Window U-value 1.10 W/m²K
Secondary heating (wood logs)
Secondary heating fuel: wood logs

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																6 * 10 =	60.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000 / (5) =	0.1297 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.3797 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3797 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	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)				
	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462	(22b)				
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	245.5778	244.8831	244.2022	241.0041	240.4058	237.6203	237.6203	237.1045	238.6932	240.4058	241.6162	242.8817 (39)
Average = Sum(39)m / 12 =												241.0012 (39)
HLP	1.2866	1.2829	1.2793	1.2626	1.2595	1.2449	1.2449	1.2422	1.2505	1.2595	1.2658	1.2724 (40)
HLP (average)												1.2626 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (65)
Solar input (sum of months) = Sum(63)m =												
Total per year (kWh/year) = Sum(64)m =												

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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	599.7562	597.4377	577.5059	544.7514	510.3333	478.0559	457.6459	464.3649	481.6767	514.6716	552.6540	582.2573 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.8900	10.6334	0.6300	0.7000	0.7700		6.1419 (74)	
East					21.3700	19.6403	0.6300	0.7000	0.7700		128.2696 (76)	
South					2.4900	46.7521	0.6300	0.7000	0.7700		35.5772 (78)	
West					11.4300	19.6403	0.6300	0.7000	0.7700		68.6065 (80)	

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	838.3514	1052.5730	1305.9284	1585.6993	1774.5573	1768.8763	1687.8137	1527.4491	1320.8562	1048.4801	847.8834	780.0208 (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	53.9770	54.1301	54.2811	55.0014	55.1383	55.7846	55.7846	55.9060	55.5339	55.1383	54.8620	54.5762
alpha	4.5985	4.6087	4.6187	4.6668	4.6759	4.7190	4.7190	4.7271	4.7023	4.6759	4.6575	4.6384
util living area	0.9995	0.9983	0.9937	0.9726	0.9041	0.7576	0.5932	0.6654	0.9020	0.9899	0.9988	0.9996 (86)
MIT	19.7661	19.8993	20.1326	20.4451	20.7136	20.8770	20.9264	20.9157	20.7772	20.4130	20.0341	19.7501 (87)
Th 2	19.8514	19.8542	19.8570	19.8703	19.8727	19.8843	19.8843	19.8864	19.8798	19.8727	19.8677	19.8625 (88)
util rest of house	0.9993	0.9977	0.9912	0.9610	0.8630	0.6623	0.4558	0.5271	0.8421	0.9842	0.9982	0.9995 (89)
MIT 2	18.1928	18.3898	18.7322	19.1920	19.5582	19.7554	19.7942	19.7910	19.6535	19.1533	18.5976	18.1779 (90)
Living area fraction	18.4082	18.5965	18.9239	19.3635	19.7163	19.9089	19.9492	19.9450	19.8073	19.3258	18.7942	18.3931 (92)
MIT	18.4082	18.5965	18.9239	19.3635	19.7163	19.9089	19.9492	19.9450	19.8073	19.3258	18.7942	18.3931 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4082	18.5965	18.9239	19.3635	19.7163	19.9089	19.9492	19.9450	19.8073	19.3258	18.7942	18.3931 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	837.4192	1049.1078	1290.6381	1512.9088	1519.0236	1175.6864	783.5584	817.3153	1105.7155	1027.5907	845.7000	779.4080 (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	3464.6572	3354.0299	3033.9529	2521.7556	1927.1739	1261.5109	795.8338	840.5236	1362.2954	2097.7274	2825.5201	3447.2467 (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	1954.6651	1548.9077	1297.0262	726.3696	303.6639	0.0000	0.0000	0.0000	0.0000	796.1817	1425.4704	1984.8720 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating 10037.1566 (98)
Space heating per m2 (98) / (4) = 52.5836 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													175.1000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													5159.0182 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1954.6651	1548.9077	1297.0262	726.3696	303.6639	0.0000	0.0000	0.0000	0.0000	796.1817	1425.4704	1984.8720	(98)
Space heating efficiency (main heating system 1)	175.1000	175.1000	175.1000	175.1000	175.1000	0.0000	0.0000	0.0000	0.0000	175.1000	175.1000	175.1000	(210)
Space heating fuel (main heating system)	1004.6822	796.1262	666.6611	373.3482	156.0808	0.0000	0.0000	0.0000	0.0000	409.2310	732.6804	1020.2083	(211)
Water heating requirement	300.7177	238.2935	199.5425	111.7492	46.7175	0.0000	0.0000	0.0000	0.0000	122.4895	219.3031	305.3649	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	128.4449	113.2095	118.8896	106.5692	104.4289	93.3034	89.6006	98.3298	98.1593	110.5065	116.8586	125.3521	(219)
Water heating fuel used												1303.6525	(219)
Annual totals kWh/year													
Space heating fuel - main system												5159.0182	(211)
Space heating fuel - secondary												1544.1779	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Total delivered energy for all uses												8612.9832	(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	5159.0182	0.5190	2677.5305	(261)
Space heating - secondary	1544.1779	0.0190	29.3394	(263)
Water heating (other fuel)	1303.6525	0.5190	676.5957	(264)
Space and water heating			3383.4655	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Total CO2, kg/year			3698.0493	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			19.3700	(273)

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

DER		19.3700	ZC1
Total Floor Area	TFA	190.8800	
Assumed number of occupants	N	2.9900	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		11.2472	ZC2
CO2 emissions from cooking, equation (L16)		0.9994	ZC3
Total CO2 emissions		31.6166	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.6166	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (Uw = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (56)												
If cylinder contains dedicated solar storage												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
223.3780 196.8488 206.6466 185.1230 181.3261 161.8946 155.3617 170.6464 170.3972 191.9678 203.1398 217.9625 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625 (64)
Total per year (kWh/year) = Sum(64)m =												2264.6926 (64)
Heat gains from water heating, kWh/month												
98.4647 87.3026 92.9015 84.9645 84.4824 77.2411 75.8493 80.9315 80.0682 88.0208 90.9551 96.6641 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
32.6231 28.9756 23.5645 17.8399 13.3355 11.2584 12.1651 15.8126 21.2237 26.9484 31.4527 33.5298 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
362.2933 366.0527 356.5790 336.4105 310.9514 287.0235 271.0381 267.2787 276.7524 296.9209 322.3800 346.3079 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 (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)												
-119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 (71)												
Water heating gains (Table 5)												
132.3451 129.9147 124.8677 118.0063 113.5517 107.2793 101.9480 108.7789 111.2059 118.3076 126.3266 129.9248 (72)												
Total internal gains	598.1121	595.7936	575.8618	543.1073	508.6892	476.4118	456.0018	462.7208	480.0326	513.0274	551.0099	580.6132 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)
East	21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)
South	2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)
West	11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	836.7073	1050.9289	1304.2843	1584.0552	1772.9132	1767.2322	1686.1696	1525.8050	1319.2121	1046.8360	846.2392	778.3767 (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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000
util living area	0.9995	0.9984	0.9936	0.9710	0.8970	0.7427	0.5757	0.6486	0.8949	0.9897	0.9988	0.9997 (86)
MIT	19.5049	19.6800	19.9848	20.3878	20.7301	20.9271	20.9832	20.9711	20.8044	20.3367	19.8455	19.4795 (87)
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054 (88)
util rest of house												
0.9993 0.9978 0.9911 0.9591 0.8547 0.6489 0.4450 0.5155 0.8338 0.9838 0.9983 0.9995 (89)												
MIT 2	17.8906	18.1483	18.5943	19.1807	19.6434	19.8733	19.9165	19.9121	19.7520	19.1164	18.3982	17.8595 (90)
Living area fraction									fLA = Living area / (4) =			0.1369 (91)
MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9988 0.9965 0.9873 0.9507 0.8490 0.6580 0.4627 0.5331 0.8322 0.9787 0.9973 0.9992 (94)												
Useful gains	835.7296	1047.2189	1287.7359	1505.9743	1505.2837	1162.8179	780.2572	813.4162	1097.8307	1024.5788	843.9235	777.7367 (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												
3241.1589 3150.8497 2869.5702 2413.8371 1866.1266 1237.4841 790.9136 833.8799 1328.8209 2002.4784 2662.0772 3228.1329 (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	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948 (98)
Space heating												9162.0152 (98)
Space heating per m2												(98) / (4) = 47.9988 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													9798.9467 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1914.0529	1511.9144	1258.7002	699.1029	287.1306	0.0000	0.0000	0.0000	0.0000	778.1361	1400.0756	1949.8340	(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	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625	(64)
Efficiency of water heater (217)m	89.1732	89.0407	88.7231	87.8988	85.8590	79.8000	79.8000	79.8000	79.8000	88.0356	88.8987	89.2224	(216)
Fuel for water heating, kWh/month	250.4991	221.0774	232.9118	210.6092	211.1906	202.8754	194.6888	213.8427	213.5304	218.0569	228.5069	244.2911	(219)
Water heating fuel used												2642.0803	(219)
Annual totals kWh/year													
Space heating fuel - main system												9798.9467	(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)												576.1345	(232)
Total delivered energy for all uses												13092.1615	(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	9798.9467	0.2160	2116.5725 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2642.0803	0.2160	570.6893 (264)
Space and water heating			2687.2618 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total CO2, kg/m2/year			3025.2006 (272)
Emissions per m2 for space and water heating			14.0783 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.5665 (272b)
Emissions per m2 for pumps and fans			0.2039 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0783 * 1.55) + 1.5665 + 0.2039, rounded to 2 d.p.			23.5900 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.0865 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3365 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3365	(21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954	(22b)				
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	241.7357	241.1902	240.6556	238.1444	237.6745	235.4873	235.4873	235.0823	236.3298	237.6745	238.6250	239.6187 (39)
Average = Sum(39)m / 12 =												238.1421 (39)
HLP	1.2664	1.2636	1.2608	1.2476	1.2452	1.2337	1.2337	1.2316	1.2381	1.2452	1.2501	1.2553 (40)
HLP (average)												1.2476 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North				1.8900	10.6334		0.6300	0.7000	0.7700	6.1419 (74)		
East				21.3700	19.6403		0.6300	0.7000	0.7700	128.2696 (76)		
South				2.4900	46.7521		0.6300	0.7000	0.7700	35.5772 (78)		
West				11.4300	19.6403		0.6300	0.7000	0.7700	68.6065 (80)		
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262 (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	54.8349	54.9589	55.0810	55.6618	55.7719	56.2899	56.2899	56.3869	56.0892	55.7719	55.5497	55.3194	
alpha	4.6557	4.6639	4.6721	4.7108	4.7181	4.7527	4.7527	4.7591	4.7393	4.7181	4.7033	4.6880	
util living area	0.9997	0.9989	0.9952	0.9772	0.9149	0.7758	0.6126	0.6889	0.9173	0.9927	0.9992	0.9998	(86)
MIT	19.4164	19.5930	19.9029	20.3169	20.6803	20.9050	20.9761	20.9594	20.7614	20.2681	19.7652	19.3911	(87)
Th 2	19.8672	19.8695	19.8717	19.8821	19.8840	19.8931	19.8931	19.8948	19.8896	19.8840	19.8801	19.8760	(88)
util rest of house	0.9996	0.9984	0.9933	0.9673	0.8770	0.6825	0.4736	0.5502	0.8636	0.9885	0.9989	0.9997	(89)
MIT 2	18.4155	18.5937	18.9045	19.3206	19.6616	19.8480	19.8870	19.8827	19.7459	19.2785	18.7743	18.3971	(90)
Living area fraction									fLA = Living area / (4) =			0.1369	(91)
MIT	18.5525	18.7305	19.0411	19.4570	19.8010	19.9927	20.0361	20.0301	19.8849	19.4140	18.9100	18.5331	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5525	18.7305	19.0411	19.4570	19.8010	19.9927	20.0361	20.0301	19.8849	19.4140	18.9100	18.5331	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9994	0.9978	0.9913	0.9624	0.8736	0.6919	0.4927	0.5688	0.8633	0.9859	0.9984	0.9996	(94)
Ext temp.	749.8971	963.3665	1210.0099	1446.3614	1479.3211	1169.3014	793.5901	823.6632	1070.9747	951.9441	760.9015	692.6215	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3445.3454	3335.7900	3018.0956	2514.0874	1925.4094	1269.9084	809.1577	853.3788	1367.1380	2094.8551	2818.1576	3434.4847	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	2005.4136	1594.2686	1345.2158	768.7628	331.8897	0.0000	0.0000	0.0000	0.0000	850.3258	1481.2244	2039.9462	(98)
Space heating per m2												10417.0468	(98)
												(98) / (4) =	54.5738 (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	2213.5807	1742.6061	1786.6253	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8066	0.8808	0.8363	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1785.5351	1534.9229	1494.1159	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	236.5114	359.5070	250.4275	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												846.4458 (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	59.1278	89.8767	62.6069	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												211.6115 (107)
Space cooling per m2												1.1086 (108)
Energy for space heating												54.5738 (99)
Energy for space cooling												1.1086 (108)
Total												55.6824 (109)
Dwelling Fabric Energy Efficiency (DFEE)												55.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (Uw = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North				1.8900	10.6334		0.6300	0.7000	0.7700	6.1419 (74)		
East				21.3700	19.6403		0.6300	0.7000	0.7700	128.2696 (76)		
South				2.4900	46.7521		0.6300	0.7000	0.7700	35.5772 (78)		
West				11.4300	19.6403		0.6300	0.7000	0.7700	68.6065 (80)		
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262 (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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001	
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000	
util living area	0.9997	0.9989	0.9951	0.9762	0.9102	0.7645	0.5988	0.6756	0.9127	0.9926	0.9993	0.9998	(86)
MIT	19.4631	19.6389	19.9453	20.3533	20.7062	20.9171	20.9802	20.9655	20.7808	20.2990	19.8048	19.4380	(87)
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054	(88)
util rest of house	0.9996	0.9985	0.9932	0.9661	0.8714	0.6719	0.4647	0.5405	0.8579	0.9883	0.9989	0.9997	(89)
MIT 2	18.4852	18.6626	18.9699	19.3799	19.7098	19.8835	19.9176	19.9141	19.7876	19.3324	18.8370	18.4671	(90)
Living area fraction									fLA = Living area / (4) =			0.1369	(91)
MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9994	0.9979	0.9913	0.9613	0.8685	0.6817	0.4831	0.5588	0.8582	0.9858	0.9985	0.9996	(94)
Ext temp.	749.9234	963.4251	1209.9958	1444.7370	1470.7292	1152.1055	778.2149	809.1015	1064.5675	951.8191	760.9442	692.6405	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3360.2576	3253.4532	2944.0321	2452.4675	1878.5794	1239.1841	791.0345	834.1019	1335.1239	2044.2913	2748.4918	3348.7675	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1942.0886	1538.8989	1290.1230	725.5659	303.4405	0.0000	0.0000	0.0000	0.0000	812.7993	1431.0343	1976.1585	(98)
Space heating per m2												10020.1090	(98)
												(98) / (4) =	52.4943 (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	2147.1638	1690.3204	1732.9265	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8231	0.8940	0.8517	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1767.3076	1511.1832	1476.0148	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	249.6352	377.1693	263.8947	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												890.6992 (104)
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	62.4088	94.2923	65.9737	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												222.6748 (107)
Space cooling per m2												1.1666 (108)
Energy for space heating												52.4943 (99)
Energy for space cooling												1.1666 (108)
Total												53.6609 (109)
Target Fabric Energy Efficiency (TFEE)												61.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	239.8212	238.6932	238.6932	237.1045	237.1045	235.1787	235.6395	234.7317	235.1787	236.1141	236.1141	237.6203 (39)
Average = Sum(39)m / 12 =												236.8328 (39)
HLP	1.2564	1.2505	1.2505	1.2422	1.2422	1.2321	1.2345	1.2297	1.2321	1.2370	1.2370	1.2449 (40)
HLP (average)												1.2407 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
RHI water heating demand												2283 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]				Area	Solar flux	g			FF	Access		Gains
				m2	Table 6a	Specific data				factor		W
					W/m2	or Table 6b				Table 6c		
North				1.8900		11.9814		0.6300	0.7000		0.7700	6.9206 (74)
East				21.3700		22.3313		0.6300	0.7000		0.7700	145.8447 (76)
South				2.4900		50.9848		0.6300	0.7000		0.7700	38.7982 (78)
West				11.4300		22.3313		0.6300	0.7000		0.7700	78.0068 (80)

Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284 (83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305 (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	55.2727	55.5339	55.5339	55.9060	55.9060	56.3637	56.2535	56.4711	56.3637	56.1405	56.1405	55.7846
alpha	4.6848	4.7023	4.7023	4.7271	4.7271	4.7576	4.7502	4.7647	4.7576	4.7427	4.7427	4.7190
util living area	0.9975	0.9946	0.9828	0.9340	0.8021	0.5499	0.3692	0.4078	0.7513	0.9628	0.9941	0.9981 (86)
MIT	19.9751	20.0904	20.3244	20.6184	20.8374	20.9301	20.9414	20.9407	20.8871	20.6014	20.2425	19.9602 (87)
Th 2	19.8751	19.8798	19.8798	19.8864	19.8864	19.8944	19.8925	19.8963	19.8944	19.8905	19.8905	19.8843 (88)
util rest of house	0.9966	0.9926	0.9762	0.9083	0.7319	0.4365	0.2384	0.2691	0.6450	0.9426	0.9914	0.9974 (89)
MIT 2	18.5165	18.6880	19.0267	19.4425	19.7139	19.8053	19.8087	19.8125	19.7764	19.4318	18.9188	18.5019 (90)
Living area fraction									fLA = Living area / (4) =			0.1369 (91)
MIT	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9952	0.9901	0.9708	0.9002	0.7306	0.4435	0.2469	0.2781	0.6487	0.9353	0.9887	0.9963 (94)
Useful gains	1139.0973	1318.8140	1522.1731	1675.5928	1463.7266	919.6548	485.8195	507.8295	1045.0379	1242.9320	1135.2905	1068.2972 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	3265.4391	3169.8460	2817.6273	2300.7270	1628.3727	931.1372	486.2985	508.6610	1112.0215	1887.0000	2620.8591	3231.9932 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	1581.9983	1243.8935	963.8179	450.0966	122.4967	0.0000	0.0000	0.0000	0.0000	479.1866	1069.6094	1609.7899 (98)
Space heating												7520.8888 (98)
RHI space heating demand												7521 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	245.5778	244.8831	244.2022	241.0041	240.4058	237.6203	237.6203	237.1045	238.6932	240.4058	241.6162	242.8817 (39)
Average = Sum(39)m / 12 =												241.0012 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2866	1.2829	1.2793	1.2626	1.2595	1.2449	1.2449	1.2422	1.2505	1.2595	1.2658	1.2724 (40)
HLP (average)												1.2626 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.8900	10.6334		0.6300		0.7000		0.7700		6.1419 (74)
East				21.3700	19.6403		0.6300		0.7000		0.7700		128.2696 (76)
South				2.4900	46.7521		0.6300		0.7000		0.7700		35.5772 (78)
West				11.4300	19.6403		0.6300		0.7000		0.7700		68.6065 (80)
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294		197.7635 (83)
Total gains	1113.6096	1324.2114	1564.7841	1826.0343	1995.5962	1975.0142	1887.4383	1730.6933	1536.8832	1283.0278	1101.7271		1048.7656 (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	53.9770	54.1301	54.2811	55.0014	55.1383	55.7846	55.7846	55.9060	55.5339	55.1383	54.8620	54.5762
alpha	4.5985	4.6087	4.6187	4.6668	4.6759	4.7190	4.7190	4.7271	4.7023	4.6759	4.6575	4.6384
util living area	0.9982	0.9956	0.9870	0.9547	0.8672	0.7035	0.5382	0.6019	0.8519	0.9780	0.9963	0.9986 (86)
MIT	19.8646	19.9957	20.2216	20.5178	20.7592	20.8949	20.9318	20.9249	20.8200	20.4914	20.1247	19.8467 (87)
Th 2	19.8514	19.8542	19.8570	19.8703	19.8727	19.8843	19.8843	19.8864	19.8798	19.8727	19.8677	19.8625 (88)
util rest of house	0.9975	0.9941	0.9822	0.9373	0.8173	0.6062	0.4097	0.4699	0.7774	0.9665	0.9947	0.9982 (89)
MIT 2	18.3369	18.5303	18.8603	19.2914	19.6110	19.7691	19.7963	19.7953	19.6972	19.2636	18.7296	18.3192 (90)
Living area fraction	18.5460	18.7309	19.0466	19.4593	19.7682	19.9232	19.9518	19.9499	19.8509	19.4317	18.9206	18.5283 (92)
MIT	18.5460	18.7309	19.0466	19.4593	19.7682	19.9232	19.9518	19.9499	19.8509	19.4317	18.9206	18.5283 (93)
Temperature adjustment												0.0000
adjusted MIT	18.5460	18.7309	19.0466	19.4593	19.7682	19.9232	19.9518	19.9499	19.8509	19.4317	18.9206	18.5283 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1109.6749	1313.5165	1529.6089	1696.7400	1620.2229	1204.6502	788.5380	827.1504	1191.1881	1231.9316	1093.6799	1045.9522 (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	3498.5012	3386.9559	3063.9191	2544.8303	1939.6324	1264.9074	796.4441	841.7062	1372.7094	2123.1897	2856.0549	3480.0736 (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	1777.2868	1393.3513	1141.5268	610.6251	237.6407	0.0000	0.0000	0.0000	0.0000	663.0960	1268.9100	1810.9864 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating
Space heating per m2

(98) / (4) = 8903.4230 (98)
46.6441 (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) 0.1000 (201)
Fraction of space heat from main system(s) 0.9000 (202)
Efficiency of main space heating system 1 (in %) 175.1000 (206)
Efficiency of secondary/supplementary heating system, % 65.0000 (208)
Space heating requirement 4576.2882 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1777.2868	1393.3513	1141.5268	610.6251	237.6407	0.0000	0.0000	0.0000	0.0000	663.0960	1268.9100	1810.9864	(98)
Space heating efficiency (main heating system 1)	175.1000	175.1000	175.1000	175.1000	175.1000	0.0000	0.0000	0.0000	0.0000	175.1000	175.1000	175.1000	(210)
Space heating fuel (main heating system)	913.5112	716.1714	586.7356	313.8564	122.1454	0.0000	0.0000	0.0000	0.0000	340.8261	652.2096	930.8325	(211)
Water heating requirement	273.4287	214.3617	175.6195	93.9423	36.5601	0.0000	0.0000	0.0000	0.0000	102.0148	195.2169	278.6133	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	128.4449	113.2095	118.8896	106.5692	104.4289	93.3034	89.6006	98.3298	98.1593	110.5065	116.8586	125.3521	(219)
Water heating fuel used												1303.6525	(219)
Annual totals kWh/year													
Space heating fuel - main system												4576.2882	(211)
Space heating fuel - secondary												1369.7574	(215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
Total electricity for the above, kWh/year 30.0000 (231)
Electricity for lighting (calculated in Appendix L) 576.1345 (232)
Total delivered energy for all uses 7855.8326 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4576.2882	13.1900	603.6124	(240)
Space heating - secondary	1369.7574	4.2300	57.9407	(242)
Water heating (other fuel)	1303.6525	13.1900	171.9518	(247)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Energy for lighting	576.1345	13.1900	75.9921	(250)
Additional standing charges			0.0000	(251)
Total energy cost			913.4541	(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] = 1.6265 (257)
SAP value 77.3108
SAP rating (Section 12) 77 (258)
SAP band C

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	4576.2882	0.5190	2375.0936	(261)
Space heating - secondary	1369.7574	0.0190	26.0254	(263)
Water heating (other fuel)	1303.6525	0.5190	676.5957	(264)
Space and water heating			3077.7147	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Total kg/year			3392.2984	(272)
CO2 emissions per m2			17.7700	(273)
EI value			80.7288	
EI rating			81	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency $13.19 \times (1 + 0.29 \times 0.25) / 1.7510 = 8.079$, stars = 2
Main heating environmental impact $0.519 \times (1 + 0.29 \times 0.25) / 1.7510 = 0.3179$, stars = 4
Water heating energy efficiency $13.19 / 1.7510 = 7.533$, stars = 2

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.519 / 1.7510 = 0.2964$, stars = 4

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	239.8212	238.6932	238.6932	237.1045	237.1045	235.1787	235.6395	234.7317	235.1787	236.1141	236.1141	237.6203 (39)
Average = Sum(39)m / 12 =												236.8328 (39)
HLP	1.2564	1.2505	1.2505	1.2422	1.2422	1.2321	1.2345	1.2297	1.2321	1.2370	1.2370	1.2449 (40)
HLP (average)												1.2407 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.8900	11.9814	0.6300	0.7000	0.7700	6.9206 (74)		
East					21.3700	22.3313	0.6300	0.7000	0.7700	145.8447 (76)		
South					2.4900	50.9848	0.6300	0.7000	0.7700	38.7982 (78)		
West					11.4300	22.3313	0.6300	0.7000	0.7700	78.0068 (80)		
Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284 (83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305 (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	55.2727	55.5339	55.5339	55.9060	55.9060	56.3637	56.2535	56.4711	56.3637	56.1405	56.1405	55.7846
alpha	4.6848	4.7023	4.7023	4.7271	4.7271	4.7576	4.7502	4.7647	4.7576	4.7427	4.7427	4.7190
util living area	0.9975	0.9946	0.9828	0.9340	0.8021	0.5499	0.3692	0.4078	0.7513	0.9628	0.9941	0.9981 (86)
MIT	19.9751	20.0904	20.3244	20.6184	20.8374	20.9301	20.9414	20.9407	20.8871	20.6014	20.2425	19.9602 (87)
Th 2	19.8751	19.8798	19.8798	19.8864	19.8864	19.8944	19.8925	19.8963	19.8944	19.8905	19.8905	19.8843 (88)
util rest of house	0.9966	0.9926	0.9762	0.9083	0.7319	0.4365	0.2384	0.2691	0.6450	0.9426	0.9914	0.9974 (89)
MIT 2	18.5165	18.6880	19.0267	19.4425	19.7139	19.8053	19.8087	19.8125	19.7764	19.4318	18.9188	18.5019 (90)
Living area fraction	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (91)
MIT	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1139.0973	1318.8140	1522.1731	1675.5928	1463.7266	919.6548	485.8195	507.8295	1045.0379	1242.9320	1135.2905	1068.2972 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	3265.4391	3169.8460	2817.6273	2300.7270	1628.3727	931.1372	486.2985	508.6610	1112.0215	1887.0000	2620.8591	3231.9932 (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	1581.9983	1243.8935	963.8179	450.0966	122.4967	0.0000	0.0000	0.0000	0.0000	479.1866	1069.6094	1609.7899 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating
Space heating per m2 (98) / (4) = 7520.8888 (98)
39.4011 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													175.1000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													3865.6767 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1581.9983	1243.8935	963.8179	450.0966	122.4967	0.0000	0.0000	0.0000	0.0000	479.1866	1069.6094	1609.7899	(98)
Space heating efficiency (main heating system 1)	175.1000	175.1000	175.1000	175.1000	175.1000	0.0000	0.0000	0.0000	0.0000	175.1000	175.1000	175.1000	(210)
Space heating fuel (main heating system)	813.1345	639.3513	495.3947	231.3461	62.9623	0.0000	0.0000	0.0000	0.0000	246.2981	549.7707	827.4191	(211)
Water heating requirement	243.3844	191.3682	148.2797	69.2456	18.8456	0.0000	0.0000	0.0000	0.0000	73.7210	164.5553	247.6600	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	128.4449	113.2095	118.8896	106.5692	104.4289	93.3034	89.6006	98.3298	98.1593	110.5065	116.8586	125.3521	(219)
Water heating fuel used												1303.6525	(219)
Annual totals kWh/year													
Space heating fuel - main system												3865.6767	(211)
Space heating fuel - secondary												1157.0598	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Total delivered energy for all uses												6932.5235	(238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3865.6767	17.5600	678.8128 (240)
Space heating - secondary	1157.0598	4.6500	53.8033 (242)
Water heating (other fuel)	1303.6525	17.5600	228.9214 (247)
Pumps and fans for heating	30.0000	17.5600	5.2680 (249)
Energy for lighting	576.1345	17.5600	101.1692 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1067.9747 (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	3865.6767	0.5190	2006.2862 (261)
Space heating - secondary	1157.0598	0.0190	21.9841 (263)
Water heating (other fuel)	1303.6525	0.5190	676.5957 (264)
Space and water heating			2704.8660 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total kg/year			3019.4498 (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	3865.6767	3.0700	11867.6275 (261)
Space heating - secondary	1157.0598	1.0400	1203.3422 (263)
Water heating (other fuel)	1303.6525	3.0700	4002.2133 (264)
Space and water heating			17073.1830 (265)
Pumps and fans	30.0000	3.0700	92.1000 (267)
Energy for lighting	576.1345	3.0700	1768.7328 (268)
Primary energy kWh/year			18934.0158 (272)
Primary energy kWh/m2/year			99.1933 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: C 77
Current environmental impact rating: B 81

(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		Recommended
L2			Not considered
Q3			Not considered
O3			Not considered
Recommended measures:			
N	Solar water heating	SAP change + 1.6	Cost change -£ 88
U	Solar photovoltaic panels	+ 5.7	-£ 320
V2	Wind turbine	+ 11.7	-£ 628
		CO2 change	
			-261 kg (8.6%)
			-947 kg (34.3%)
			-1856 kg (102.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£88	1.37 kg/m²	C 79 B 82
Solar photovoltaic panels	£320	4.96 kg/m²	B 85 B 87
Wind turbine	£628	9.72 kg/m²	A 96 A 98
Total Savings	£1036	16.05 kg/m²	

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

Fuel prices for cost data on this page from database revision number 445 TEST (30 Jul 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£1014	£926	£88
Wood	£54	£54	-£0
Space heating	£738	£739	-£1
Water heating	£229	£140	£89
Lighting	£101	£101	£0
Generated (PV)	-£0	-£320	£320
Generated (wind)	-£0	-£628	£628
Total cost of fuels	£1068	£32	£1036
Total cost of uses	£1068	£32	£1036
Delivered energy	36 kWh/m²	5 kWh/m²	31 kWh/m²
Carbon dioxide emissions	3.0 tonnes	0.0 tonnes	3.1 tonnes
CO2 emissions per m²	16 kg/m²	0 kg/m²	16 kg/m²
Primary energy	99 kWh/m²	4 kWh/m²	95 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	245.5778	244.8831	244.2022	241.0041	240.4058	237.6203	237.6203	237.1045	238.6932	240.4058	241.6162	242.8817 (39)
Average = Sum(39)m / 12 =												241.0012 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2866	1.2829	1.2793	1.2626	1.2595	1.2449	1.2449	1.2422	1.2505	1.2595	1.2658	1.2724 (40)
HLP (average)												1.2626 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	206.7799	179.8491	170.0608	150.7676	143.8638	160.0790	166.4741	192.1011	204.6195	219.4915 (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												1.0956 (H8)
Utilisation factor												0.5986 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												0.7128 (H15)
Solar storage volume factor												0.9323 (H16)
Solar input												-889.9440 (H17)
Solar input	-25.8066	-43.0638	-73.3426	-98.2935	-121.4334	-119.3883	-117.8106	-102.9317	-80.6162	-55.0513	-30.6103	-21.5957 (63)
Solar input (sum of months) = Sum(63)m =												-889.9440 (63)
Output from w/h	199.1005	155.1661	133.4373	81.5555	48.6274	31.3792	26.0532	57.1473	85.8579	137.0498	174.0091	197.8958 (64)
Total per year (kWh/year) = Sum(64)m =												1327.2792 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	93.0082	80.7454	75.4702	68.3395	66.6510	72.4775	76.9297	88.1275	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	125.0110	112.1464	101.4385	94.9160	89.5846	97.4160	106.8468	118.4509	127.9707	131.5689	(72)
Total internal gains	875.0143	869.0762	834.8608	777.5824	717.6149	670.1863	643.2630	654.6022	691.7005	747.7184	806.4977	851.0021	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W
North					1.8900	10.6334	0.6300	0.7000				0.7700			6.1419 (74)
East					21.3700	19.6403	0.6300	0.7000				0.7700			128.2696 (76)
South					2.4900	46.7521	0.6300	0.7000				0.7700			35.5772 (78)
West					11.4300	19.6403	0.6300	0.7000				0.7700			68.6065 (80)

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294			197.7635 (83)	
Total gains	1113.6096	1324.2114	1563.2833	1818.5303	1981.8389	1961.0067	1873.4308	1717.6864	1530.8800	1281.5270	1101.7271			1048.7656 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	53.9770	54.1301	54.2811	55.0014	55.1383	55.7846	55.7846	55.9060	55.5339	55.1383	54.8620	54.5762	
alpha	4.5985	4.6087	4.6187	4.6668	4.6759	4.7190	4.7190	4.7271	4.7023	4.6759	4.6575	4.6384	
util living area	0.9982	0.9956	0.9871	0.9554	0.8696	0.7071	0.5418	0.6057	0.8534	0.9781	0.9963	0.9986	(86)
MIT	19.8646	19.9957	20.2210	20.5157	20.7566	20.8939	20.9315	20.9244	20.8189	20.4909	20.1247	19.8467	(87)
Th 2	19.8514	19.8542	19.8570	19.8703	19.8727	19.8843	19.8843	19.8864	19.8798	19.8727	19.8677	19.8625	(88)
util rest of house													
	0.9975	0.9941	0.9823	0.9381	0.8202	0.6098	0.4126	0.4733	0.7792	0.9666	0.9947	0.9982	(89)
MIT 2	18.3369	18.5303	18.8596	19.2885	19.6081	19.7684	19.7962	19.7951	19.6962	19.2629	18.7296	18.3192	(90)
Living area fraction													fLA = Living area / (4) = 0.1369 (91)

MIT	18.5460	18.7309	19.0460	19.4565	19.7653	19.9224	19.9516	19.9497	19.8499	19.4310	18.9206	18.5283 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5460	18.7309	19.0460	19.4565	19.7653	19.9224	19.9516	19.9497	19.8499	19.4310	18.9206	18.5283 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9965	0.9919	0.9776	0.9300	0.8147	0.6135	0.4208	0.4813	0.7768	0.9603	0.9927	0.9973 (94)
Useful gains	1109.6749	1313.5165	1528.2594	1691.3196	1614.5704	1203.0175	788.2655	826.6659	1189.1773	1230.6859	1093.6799	1045.9522 (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	3498.5012	3386.9559	3063.7493	2544.1498	1938.9408	1264.7167	796.4105	841.6478	1372.4664	2123.0340	2856.0549	3480.0736 (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	1777.2868	1393.3513	1142.4045	614.0378	241.3316	0.0000	0.0000	0.0000	0.0000	663.9070	1268.9100	1810.9864 (98)
Space heating												8912.2153 (98)
Space heating per m2										(98) / (4) =		46.6901 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP band

A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4580.8074	0.5190	2377.4390 (261)
Space heating - secondary	1371.1100	0.0190	26.0511 (263)
Water heating (other fuel)	758.0121	0.5190	393.4083 (264)
Space and water heating			2796.8984 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			385.2893 (272)
CO2 emissions per m2			2.0200 (273)
EI value			97.8112
EI rating			98 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
Effective ac	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	239.8212	238.6932	238.6932	237.1045	237.1045	235.1787	235.6395	234.7317	235.1787	236.1141	236.1141	237.6203 (39)
Average = Sum(39)m / 12 =												236.8328 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2564	1.2505	1.2505	1.2422	1.2422	1.2321	1.2345	1.2297	1.2321	1.2370	1.2370	1.2449 (40)
HLP (average)												1.2407 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	206.7799	179.8491	170.0608	150.7676	143.8638	160.0790	166.4741	192.1011	204.6195	219.4915 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1570 (H8)
Utilisation factor												0.5786 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												0.7128 (H15)
Solar storage volume factor												0.9323 (H16)
Solar input												-908.5616 (H17)
Solar input	-27.9651	-42.0314	-70.7863	-97.8483	-117.8423	-124.0239	-121.0458	-108.0946	-84.3682	-57.3941	-33.9923	-23.1692 (63)
Solar input (sum of months) = Sum(63)m =												-908.5616 (63)
Output from w/h	196.9420	156.1984	135.9936	82.0007	52.2185	26.7437	22.8180	51.9844	82.1058	134.7070	170.6272	196.3223 (64)
Total per year (kWh/year) = Sum(64)m =												1308.6616 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	93.0082	80.7454	75.4702	68.3395	66.6510	72.4775	76.9297	88.1275	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	125.0110	112.1464	101.4385	94.9160	89.5846	97.4160	106.8468	118.4509	127.9707	131.5689	(72)
Total internal gains	875.0143	869.0762	834.8608	777.5824	717.6149	670.1863	643.2630	654.6022	691.7005	747.7184	806.4977	851.0021	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				1.8900	11.9814		0.6300		0.7000		0.7700		6.9206 (74)	
East				21.3700	22.3313		0.6300		0.7000		0.7700		145.8447 (76)	
South				2.4900	50.9848		0.6300		0.7000		0.7700		38.7982 (78)	
West				11.4300	22.3313		0.6300		0.7000		0.7700		78.0068 (80)	
Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284 (83)		
Total gains	1144.5846	1332.0067	1566.4819	1853.7717	1989.7903	2059.8031	1953.4457	1813.2508	1604.9328	1327.4305	1148.2845	1072.2305 (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	55.2727	55.5339	55.5339	55.9060	55.9060	56.3637	56.2535	56.4711	56.3637	56.1405	56.1405	55.7846
alpha	4.6848	4.7023	4.7023	4.7271	4.7271	4.7576	4.7502	4.7647	4.7576	4.7427	4.7427	4.7190
util living area	0.9975	0.9946	0.9829	0.9348	0.8051	0.5532	0.3717	0.4106	0.7531	0.9630	0.9941	0.9981 (86)
MIT	19.9751	20.0904	20.3239	20.6164	20.8356	20.9297	20.9414	20.9407	20.8865	20.6009	20.2425	19.9602 (87)
Th 2	19.8751	19.8798	19.8798	19.8864	19.8864	19.8944	19.8925	19.8963	19.8944	19.8905	19.8905	19.8843 (88)
util rest of house	0.9966	0.9926	0.9763	0.9094	0.7353	0.4394	0.2401	0.2710	0.6469	0.9429	0.9914	0.9974 (89)
MIT 2	18.5165	18.6880	19.0260	19.4399	19.7122	19.8052	19.8087	19.8125	19.7759	19.4312	18.9188	18.5019 (90)
Living area fraction									fLA = Living area /	(4) =		0.1369 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

MIT	18.7161	18.8800	19.2037	19.6010	19.8660	19.9591	19.9637	19.9670	19.9280	19.5913	19.1000	18.7015 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7161	18.8800	19.2037	19.6010	19.8660	19.9591	19.9637	19.9670	19.9280	19.5913	19.1000	18.7015 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9901	0.9709	0.9013	0.7338	0.4463	0.2487	0.2800	0.6506	0.9355	0.9887	0.9963 (94)	
Useful gains	1139.0973	1318.8140	1520.8666	1670.8680	1460.1600	919.3002	485.8012	507.7985	1044.1296	1241.8228	1135.2905	1068.2972 (95)	
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)	
Heat loss rate W	3265.4391	3169.8460	2817.4654	2300.1433	1627.9500	931.0952	486.2956	508.6563	1111.9151	1886.8630	2620.8591	3231.9932 (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	1581.9983	1243.8935	964.6695	453.0782	124.8358	0.0000	0.0000	0.0000	0.0000	479.9099	1069.6094	1609.7899 (98)	
Space heating												7527.7844 (98)	
Space heating per m2												(98) / (4) = 39.4373 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													175.1000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													3869.2210 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1581.9983	1243.8935	964.6695	453.0782	124.8358	0.0000	0.0000	0.0000	0.0000	479.9099	1069.6094	1609.7899 (98)	
Space heating efficiency (main heating system 1)	175.1000	175.1000	175.1000	175.1000	175.1000	0.0000	0.0000	0.0000	0.0000	175.1000	175.1000	175.1000 (210)	
Space heating fuel (main heating system)	813.1345	639.3513	495.8324	232.8786	64.1646	0.0000	0.0000	0.0000	0.0000	246.6699	549.7707	827.4191 (211)	
Water heating requirement	243.3844	191.3682	148.4107	69.7043	19.2055	0.0000	0.0000	0.0000	0.0000	73.8323	164.5553	247.6600 (215)	
Water heating													
Water heating requirement	196.9420	156.1984	135.9936	82.0007	52.2185	26.7437	22.8180	51.9844	82.1058	134.7070	170.6272	196.3223 (64)	
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)	
Fuel for water heating, kWh/month	112.4740	89.2053	77.6663	46.8308	29.8221	15.2734	13.0314	29.6884	46.8908	76.9314	97.4456	112.1201 (219)	
Water heating fuel used												747.3796 (219)	
Annual totals kWh/year													
Space heating fuel - main system													3869.2210 (211)
Space heating fuel - secondary													1158.1207 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													80.0000 (231)
Electricity for lighting (calculated in Appendix L)													576.1345 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596				-1824.1596 (233)
Wind generation													-3575.5408 (234)
Total delivered energy for all uses													1031.1553 (238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3869.2210	17.5600	679.4352 (240)	
Space heating - secondary	1158.1207	4.6500	53.8526 (242)	
Water heating (other fuel)	747.3796	17.5600	131.2399 (247)	
Pumps and fans for heating	30.0000	17.5600	5.2680 (249)	
Pump for solar water heating	50.0000	17.5600	8.7800 (249)	
Energy for lighting	576.1345	17.5600	101.1692 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1824.1596	17.5600	-320.3224 (252)	
Wind Turbine	-3575.5408	17.5600	-627.8650 (252)	
Total energy cost			31.5575 (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	3869.2210	0.5190	2008.1257 (261)	
Space heating - secondary	1158.1207	0.0190	22.0043 (263)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Water heating (other fuel)	747.3796	0.5190	387.8900 (264)
Space and water heating			2418.0200 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-43.8907 (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	3869.2210	3.0700	11878.5085 (261)
Space heating - secondary	1158.1207	1.0400	1204.4455 (263)
Water heating (other fuel)	747.3796	3.0700	2294.4552 (264)
Space and water heating			15377.4092 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	576.1345	3.0700	1768.7328 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Wind Turbine	-3575.5408	3.0700	-10976.9101 (269)
Primary energy kWh/year			814.6618 (272)
Primary energy kWh/m2/year			4.2679 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0669 V2			Issued on Date	16/07/2019
Assessment Reference	Rev E	Prop Type Ref			
Property					
SAP Rating	82 B	DER	15.51	TER	23.59
Environmental	85 B	% DER<TER	34.26		
CO ₂ Emissions (t/year)	2.43	DFEE	55.68	TFEE	61.71
General Requirements Compliance	Pass	% DFEE<TFEE	9.77		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com			Assessor ID	E477-0001
Client	HJ Concepts, HJC				

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

Detached House, total floor area 191 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:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 23.59 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.51 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)55.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (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: Heat pump with radiators or underfloor - Electric
Ground-to-water heat pump

Secondary heating system: Room heaters - Wood Logs

Closed room heater

Efficiency: 65%

Minimum: 65% OK

5 Cylinder insulation

Hot water storage Nominal cylinder loss: 1.79 kWh/day

Permitted by DBSCG 2.30 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading:	Average
Windows facing North:	1.89 m ² , No overhang
Windows facing East:	21.37 m ² , No overhang
Windows facing South:	2.49 m ² , No overhang
Windows facing West:	11.43 m ² , Overhang twice as wide as window, ratio 1.88
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Roof U-value	0.10 W/m ² K
Floor U-value	0.10 W/m ² K
Door U-value	0.12 W/m ² K
Window U-value	1.10 W/m ² K
Secondary heating (wood logs)	1.10 W/m ² K
Secondary heating fuel:	wood logs

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																6 * 10 =	60.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000 / (5) =	0.1297 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.3797 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3797 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Adj infilt rate	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)					
	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)					
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)					

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	245.5778	244.8831	244.2022	241.0041	240.4058	237.6203	237.6203	237.1045	238.6932	240.4058	241.6162	242.8817 (39)
Average = Sum(39)m / 12 =												241.0012 (39)
HLP	1.2866	1.2829	1.2793	1.2626	1.2595	1.2449	1.2449	1.2422	1.2505	1.2595	1.2658	1.2724 (40)
HLP (average)												1.2626 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (65)
Solar input (sum of months) = Sum (63)m =												
Total per year (kWh/year) = Sum (64)m =												

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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	599.7562	597.4377	577.5059	544.7514	510.3333	478.0559	457.6459	464.3649	481.6767	514.6716	552.6540	582.2573 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.8900	10.6334	0.6300	0.7000	0.7700		6.1419 (74)	
East					21.3700	19.6403	0.6300	0.7000	0.7700		128.2696 (76)	
South					2.4900	46.7521	0.6300	0.7000	0.7700		35.5772 (78)	
West					11.4300	19.6403	0.6300	0.7000	0.7700		68.6065 (80)	

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	838.3514	1052.5730	1305.9284	1585.6993	1774.5573	1768.8763	1687.8137	1527.4491	1320.8562	1048.4801	847.8834	780.0208 (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	53.9770	54.1301	54.2811	55.0014	55.1383	55.7846	55.7846	55.9060	55.5339	55.1383	54.8620	54.5762
alpha	4.5985	4.6087	4.6187	4.6668	4.6759	4.7190	4.7190	4.7271	4.7023	4.6759	4.6575	4.6384
util living area	0.9995	0.9983	0.9937	0.9726	0.9041	0.7576	0.5932	0.6654	0.9020	0.9899	0.9988	0.9996 (86)
MIT	19.7661	19.8993	20.1326	20.4451	20.7136	20.8770	20.9264	20.9157	20.7772	20.4130	20.0341	19.7501 (87)
Th 2	19.8514	19.8542	19.8570	19.8703	19.8727	19.8843	19.8843	19.8864	19.8798	19.8727	19.8677	19.8625 (88)
util rest of house	0.9993	0.9977	0.9912	0.9610	0.8630	0.6623	0.4558	0.5271	0.8421	0.9842	0.9982	0.9995 (89)
MIT 2	18.1928	18.3898	18.7322	19.1920	19.5582	19.7554	19.7942	19.7910	19.6535	19.1533	18.5976	18.1779 (90)
Living area fraction	18.4082	18.5965	18.9239	19.3635	19.7163	19.9089	19.9492	19.9450	19.8073	19.3258	18.7942	18.3931 (92)
MIT	18.4082	18.5965	18.9239	19.3635	19.7163	19.9089	19.9492	19.9450	19.8073	19.3258	18.7942	18.3931 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4082	18.5965	18.9239	19.3635	19.7163	19.9089	19.9492	19.9450	19.8073	19.3258	18.7942	18.3931 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	837.4192	1049.1078	1290.6381	1512.9088	1519.0236	1175.6864	783.5584	817.3153	1105.7155	1027.5907	845.7000	779.4080 (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	3464.6572	3354.0299	3033.9529	2521.7556	1927.1739	1261.5109	795.8338	840.5236	1362.2954	2097.7274	2825.5201	3447.2467 (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	1954.6651	1548.9077	1297.0262	726.3696	303.6639	0.0000	0.0000	0.0000	0.0000	796.1817	1425.4704	1984.8720 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating 10037.1566 (98)
Space heating per m2 (98) / (4) = 52.5836 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													224.4000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													4025.5976 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1954.6651	1548.9077	1297.0262	726.3696	303.6639	0.0000	0.0000	0.0000	0.0000	796.1817	1425.4704	1984.8720	(98)
Space heating efficiency (main heating system 1)	224.4000	224.4000	224.4000	224.4000	224.4000	0.0000	0.0000	0.0000	0.0000	224.4000	224.4000	224.4000	(210)
Space heating fuel (main heating system)	783.9566	621.2197	520.1977	291.3247	121.7903	0.0000	0.0000	0.0000	0.0000	319.3242	571.7127	796.0717	(211)
Water heating requirement	300.7177	238.2935	199.5425	111.7492	46.7175	0.0000	0.0000	0.0000	0.0000	122.4895	219.3031	305.3649	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	(216)
Fuel for water heating, kWh/month	100.2260	88.3377	92.7699	83.1563	81.4862	72.8049	69.9157	76.7270	76.5940	86.2285	91.1852	97.8126	(219)
Water heating fuel used												1017.2440	(219)
Annual totals kWh/year													
Space heating fuel - main system												4025.5976	(211)
Space heating fuel - secondary												1544.1779	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Total delivered energy for all uses												7193.1540	(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	4025.5976	0.5190	2089.2851 (261)
Space heating - secondary	1544.1779	0.0190	29.3394 (263)
Water heating (other fuel)	1017.2440	0.5190	527.9496 (264)
Space and water heating			2646.5742 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total CO2, kg/year			2961.1579 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.5100 (273)

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

DER		15.5100	ZC1
Total Floor Area	TFA	190.8800	
Assumed number of occupants	N	2.9900	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		11.2472	ZC2
CO2 emissions from cooking, equation (L16)		0.9994	ZC3
Total CO2 emissions		27.7566	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.7566	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (Uw = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (56)												
If cylinder contains dedicated solar storage												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
223.3780 196.8488 206.6466 185.1230 181.3261 161.8946 155.3617 170.6464 170.3972 191.9678 203.1398 217.9625 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625 (64)
Total per year (kWh/year) = Sum(64)m =												2264.6926 (64)
Heat gains from water heating, kWh/month												
98.4647 87.3026 92.9015 84.9645 84.4824 77.2411 75.8493 80.9315 80.0682 88.0208 90.9551 96.6641 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
32.6231 28.9756 23.5645 17.8399 13.3355 11.2584 12.1651 15.8126 21.2237 26.9484 31.4527 33.5298 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
362.2933 366.0527 356.5790 336.4105 310.9514 287.0235 271.0381 267.2787 276.7524 296.9209 322.3800 346.3079 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 (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)												
-119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 (71)												
Water heating gains (Table 5)												
132.3451 129.9147 124.8677 118.0063 113.5517 107.2793 101.9480 108.7789 111.2059 118.3076 126.3266 129.9248 (72)												
Total internal gains	598.1121	595.7936	575.8618	543.1073	508.6892	476.4118	456.0018	462.7208	480.0326	513.0274	551.0099	580.6132 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)
East	21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)
South	2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)
West	11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	836.7073	1050.9289	1304.2843	1584.0552	1772.9132	1767.2322	1686.1696	1525.8050	1319.2121	1046.8360	846.2392	778.3767 (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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000
util living area	0.9995	0.9984	0.9936	0.9710	0.8970	0.7427	0.5757	0.6486	0.8949	0.9897	0.9988	0.9997 (86)
MIT	19.5049	19.6800	19.9848	20.3878	20.7301	20.9271	20.9832	20.9711	20.8044	20.3367	19.8455	19.4795 (87)
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054 (88)
util rest of house												
0.9993 0.9978 0.9911 0.9591 0.8547 0.6489 0.4450 0.5155 0.8338 0.9838 0.9983 0.9995 (89)												
MIT 2	17.8906	18.1483	18.5943	19.1807	19.6434	19.8733	19.9165	19.9121	19.7520	19.1164	18.3982	17.8595 (90)
Living area fraction												
MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (91)
Temperature adjustment												0.0000
adjusted MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9988 0.9965 0.9873 0.9507 0.8490 0.6580 0.4627 0.5331 0.8322 0.9787 0.9973 0.9992 (94)												
Useful gains	835.7296	1047.2189	1287.7359	1505.9743	1505.2837	1162.8179	780.2572	813.4162	1097.8307	1024.5788	843.9235	777.7367 (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												
3241.1589 3150.8497 2869.5702 2413.8371 1866.1266 1237.4841 790.9136 833.8799 1328.8209 2002.4784 2662.0772 3228.1329 (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	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948 (98)
Space heating												9162.0152 (98)
Space heating per m2												(98) / (4) = 47.9988 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													9798.9467 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1914.0529	1511.9144	1258.7002	699.1029	287.1306	0.0000	0.0000	0.0000	0.0000	778.1361	1400.0756	1949.8340	(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	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625	(64)
Efficiency of water heater (217)m	89.1732	89.0407	88.7231	87.8988	85.8590	79.8000	79.8000	79.8000	79.8000	88.0356	88.8987	89.2224	(216)
Fuel for water heating, kWh/month	250.4991	221.0774	232.9118	210.6092	211.1906	202.8754	194.6888	213.8427	213.5304	218.0569	228.5069	244.2911	(219)
Water heating fuel used												2642.0803	(219)
Annual totals kWh/year													
Space heating fuel - main system												9798.9467	(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)												576.1345	(232)
Total delivered energy for all uses												13092.1615	(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	9798.9467	0.2160	2116.5725 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2642.0803	0.2160	570.6893 (264)
Space and water heating			2687.2618 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total CO2, kg/m2/year			3025.2006 (272)
Emissions per m2 for space and water heating			14.0783 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.5665 (272b)
Emissions per m2 for pumps and fans			0.2039 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0783 * 1.55) + 1.5665 + 0.2039, rounded to 2 d.p.			23.5900 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.0865 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3365 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3365 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954	(22b)				
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	241.7357	241.1902	240.6556	238.1444	237.6745	235.4873	235.4873	235.0823	236.3298	237.6745	238.6250	239.6187 (39)
Average = Sum(39)m / 12 =												238.1421 (39)
HLP	1.2664	1.2636	1.2608	1.2476	1.2452	1.2337	1.2337	1.2316	1.2381	1.2452	1.2501	1.2553 (40)
HLP (average)												1.2476 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North					1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)			
East					21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)			
South					2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)			
West					11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)			

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635	(83)
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262	(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	54.8349	54.9589	55.0810	55.6618	55.7719	56.2899	56.2899	56.3869	56.0892	55.7719	55.5497	55.3194	
alpha	4.6557	4.6639	4.6721	4.7108	4.7181	4.7527	4.7527	4.7591	4.7393	4.7181	4.7033	4.6880	
util living area	0.9997	0.9989	0.9952	0.9772	0.9149	0.7758	0.6126	0.6889	0.9173	0.9927	0.9992	0.9998	(86)
MIT	19.4164	19.5930	19.9029	20.3169	20.6803	20.9050	20.9761	20.9594	20.7614	20.2681	19.7652	19.3911	(87)
Th 2	19.8672	19.8695	19.8717	19.8821	19.8840	19.8931	19.8931	19.8948	19.8896	19.8840	19.8801	19.8760	(88)
util rest of house	0.9996	0.9984	0.9933	0.9673	0.8770	0.6825	0.4736	0.5502	0.8636	0.9885	0.9989	0.9997	(89)
MIT 2	18.4155	18.5937	18.9045	19.3206	19.6616	19.8480	19.8870	19.8827	19.7459	19.2785	18.7743	18.3971	(90)
Living area fraction									fLA = Living area / (4) =			0.1369	(91)
MIT	18.5525	18.7305	19.0411	19.4570	19.8010	19.9927	20.0361	20.0301	19.8849	19.4140	18.9100	18.5331	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5525	18.7305	19.0411	19.4570	19.8010	19.9927	20.0361	20.0301	19.8849	19.4140	18.9100	18.5331	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9994	0.9978	0.9913	0.9624	0.8736	0.6919	0.4927	0.5688	0.8633	0.9859	0.9984	0.9996	(94)
Ext temp.	749.8971	963.3665	1210.0099	1446.3614	1479.3211	1169.3014	793.5901	823.6632	1070.9747	951.9441	760.9015	692.6215	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3445.3454	3335.7900	3018.0956	2514.0874	1925.4094	1269.9084	809.1577	853.3788	1367.1380	2094.8551	2818.1576	3434.4847	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	2005.4136	1594.2686	1345.2158	768.7628	331.8897	0.0000	0.0000	0.0000	0.0000	850.3258	1481.2244	2039.9462	(98)
Space heating per m2												10417.0468	(98)
												(98) / (4) =	54.5738 (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	2213.5807	1742.6061	1786.6253	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8066	0.8808	0.8363	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1785.5351	1534.9229	1494.1159	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	236.5114	359.5070	250.4275	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												846.4458 (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	59.1278	89.8767	62.6069	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												211.6115 (107)
Space cooling per m2												1.1086 (108)
Energy for space heating												54.5738 (99)
Energy for space cooling												1.1086 (108)
Total												55.6824 (109)
Dwelling Fabric Energy Efficiency (DFEE)												55.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (Uw = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)		
East					21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)		
South					2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)		
West					11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)		
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262 (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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001	
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000	
util living area	0.9997	0.9989	0.9951	0.9762	0.9102	0.7645	0.5988	0.6756	0.9127	0.9926	0.9993	0.9998 (86)	
MIT	19.4631	19.6389	19.9453	20.3533	20.7062	20.9171	20.9802	20.9655	20.7808	20.2990	19.8048	19.4380 (87)	
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054 (88)	
util rest of house	0.9996	0.9985	0.9932	0.9661	0.8714	0.6719	0.4647	0.5405	0.8579	0.9883	0.9989	0.9997 (89)	
MIT 2	18.4852	18.6626	18.9699	19.3799	19.7098	19.8835	19.9176	19.9141	19.7876	19.3324	18.8370	18.4671 (90)	
Living area fraction									fLA = Living area / (4) =			0.1369 (91)	
MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9994	0.9979	0.9913	0.9613	0.8685	0.6817	0.4831	0.5588	0.8582	0.9858	0.9985	0.9996 (94)
Useful gains	749.9234	963.4251	1209.9958	1444.7370	1470.7292	1152.1055	778.2149	809.1015	1064.5675	951.8191	760.9442	692.6405 (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	3360.2576	3253.4532	2944.0321	2452.4675	1878.5794	1239.1841	791.0345	834.1019	1335.1239	2044.2913	2748.4918	3348.7675 (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	1942.0886	1538.8989	1290.1230	725.5659	303.4405	0.0000	0.0000	0.0000	0.0000	812.7993	1431.0343	1976.1585 (98)
Space heating												10020.1090 (98)
Space heating per m2										(98) / (4) =		52.4943 (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	2147.1638	1690.3204	1732.9265	0.0000	0.0000	0.0000	0.0000 (100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8231	0.8940	0.8517	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1767.3076	1511.1832	1476.0148	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	249.6352	377.1693	263.8947	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												890.6992 (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	62.4088	94.2923	65.9737	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												222.6748 (107)
Space cooling per m2												1.1666 (108)
Energy for space heating												52.4943 (99)
Energy for space cooling												1.1666 (108)
Total												53.6609 (109)
Target Fabric Energy Efficiency (TFEE)												61.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	239.8212	238.6932	238.6932	237.1045	237.1045	235.1787	235.6395	234.7317	235.1787	236.1141	236.1141	237.6203 (39)
Average = Sum(39)m / 12 =												236.8328 (39)
HLP	1.2564	1.2505	1.2505	1.2422	1.2422	1.2321	1.2345	1.2297	1.2321	1.2370	1.2370	1.2449 (40)
HLP (average)												1.2407 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
RHI water heating demand												2283 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					1.8900	11.9814	0.6300		0.7000	0.7700		6.9206 (74)
East					21.3700	22.3313	0.6300		0.7000	0.7700		145.8447 (76)
South					2.4900	50.9848	0.6300		0.7000	0.7700		38.7982 (78)
West					11.4300	22.3313	0.6300		0.7000	0.7700		78.0068 (80)

Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284 (83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305 (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	55.2727	55.5339	55.5339	55.9060	55.9060	56.3637	56.2535	56.4711	56.3637	56.1405	56.1405	55.7846
alpha	4.6848	4.7023	4.7023	4.7271	4.7271	4.7576	4.7502	4.7647	4.7576	4.7427	4.7427	4.7190
util living area	0.9975	0.9946	0.9828	0.9340	0.8021	0.5499	0.3692	0.4078	0.7513	0.9628	0.9941	0.9981 (86)
MIT	19.9751	20.0904	20.3244	20.6184	20.8374	20.9301	20.9414	20.9407	20.8871	20.6014	20.2425	19.9602 (87)
Th 2	19.8751	19.8798	19.8798	19.8864	19.8864	19.8944	19.8925	19.8963	19.8944	19.8905	19.8905	19.8843 (88)
util rest of house	0.9966	0.9926	0.9762	0.9083	0.7319	0.4365	0.2384	0.2691	0.6450	0.9426	0.9914	0.9974 (89)
MIT 2	18.5165	18.6880	19.0267	19.4425	19.7139	19.8053	19.8087	19.8125	19.7764	19.4318	18.9188	18.5019 (90)
Living area fraction									fLA = Living area / (4) =			0.1369 (91)
MIT	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9952	0.9901	0.9708	0.9002	0.7306	0.4435	0.2469	0.2781	0.6487	0.9353	0.9887	0.9963 (94)
Useful gains	1139.0973	1318.8140	1522.1731	1675.5928	1463.7266	919.6548	485.8195	507.8295	1045.0379	1242.9320	1135.2905	1068.2972 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	3265.4391	3169.8460	2817.6273	2300.7270	1628.3727	931.1372	486.2985	508.6610	1112.0215	1887.0000	2620.8591	3231.9932 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	1581.9983	1243.8935	963.8179	450.0966	122.4967	0.0000	0.0000	0.0000	0.0000	479.1866	1069.6094	1609.7899 (98)
Space heating												7520.8888 (98)
RHI space heating demand												7521 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	245.5778	244.8831	244.2022	241.0041	240.4058	237.6203	237.6203	237.1045	238.6932	240.4058	241.6162	242.8817 (39)
Average = Sum(39)m / 12 =												241.0012 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2866	1.2829	1.2793	1.2626	1.2595	1.2449	1.2449	1.2422	1.2505	1.2595	1.2658	1.2724 (40)
HLP (average)												1.2626 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)
East	21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)
South	2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)
West	11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	1113.6096	1324.2114	1564.7841	1826.0343	1995.5962	1975.0142	1887.4383	1730.6933	1536.8832	1283.0278	1101.7271	1048.7656 (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	53.9770	54.1301	54.2811	55.0014	55.1383	55.7846	55.7846	55.9060	55.5339	55.1383	54.8620	54.5762
alpha	4.5985	4.6087	4.6187	4.6668	4.6759	4.7190	4.7190	4.7271	4.7023	4.6759	4.6575	4.6384
util living area	0.9982	0.9956	0.9870	0.9547	0.8672	0.7035	0.5382	0.6019	0.8519	0.9780	0.9963	0.9986 (86)
MIT	19.8646	19.9957	20.2216	20.5178	20.7592	20.8949	20.9318	20.9249	20.8200	20.4914	20.1247	19.8467 (87)
Th 2	19.8514	19.8542	19.8570	19.8703	19.8727	19.8843	19.8843	19.8864	19.8798	19.8727	19.8677	19.8625 (88)
util rest of house	0.9975	0.9941	0.9822	0.9373	0.8173	0.6062	0.4097	0.4699	0.7774	0.9665	0.9947	0.9982 (89)
MIT 2	18.3369	18.5303	18.8603	19.2914	19.6110	19.7691	19.7963	19.7953	19.6972	19.2636	18.7296	18.3192 (90)
Living area fraction	18.5460	18.7309	19.0466	19.4593	19.7682	19.9232	19.9518	19.9499	19.8509	19.4317	18.9206	18.5283 (92)
MIT	18.5460	18.7309	19.0466	19.4593	19.7682	19.9232	19.9518	19.9499	19.8509	19.4317	18.9206	18.5283 (93)
Temperature adjustment												0.0000
adjusted MIT	18.5460	18.7309	19.0466	19.4593	19.7682	19.9232	19.9518	19.9499	19.8509	19.4317	18.9206	18.5283 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1109.6749	1313.5165	1529.6089	1696.7400	1620.2229	1204.6502	788.5380	827.1504	1191.1881	1231.9316	1093.6799	1045.9522 (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	3498.5012	3386.9559	3063.9191	2544.8303	1939.6324	1264.9074	796.4441	841.7062	1372.7094	2123.1897	2856.0549	3480.0736 (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	1777.2868	1393.3513	1141.5268	610.6251	237.6407	0.0000	0.0000	0.0000	0.0000	663.0960	1268.9100	1810.9864 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating 8903.4230 (98)
Space heating per m2 (98) / (4) = 46.6441 (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) 0.1000 (201)
Fraction of space heat from main system(s) 0.9000 (202)
Efficiency of main space heating system 1 (in %) 224.4000 (206)
Efficiency of secondary/supplementary heating system, % 65.0000 (208)
Space heating requirement 3570.8916 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1777.2868	1393.3513	1141.5268	610.6251	237.6407	0.0000	0.0000	0.0000	0.0000	663.0960	1268.9100	1810.9864	(98)
Space heating efficiency (main heating system 1)	224.4000	224.4000	224.4000	224.4000	224.4000	0.0000	0.0000	0.0000	0.0000	224.4000	224.4000	224.4000	(210)
Space heating fuel (main heating system)	712.8156	558.8307	457.8316	244.9031	95.3104	0.0000	0.0000	0.0000	0.0000	265.9476	508.9211	726.3314	(211)
Water heating requirement	273.4287	214.3617	175.6195	93.9423	36.5601	0.0000	0.0000	0.0000	0.0000	102.0148	195.2169	278.6133	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	(216)
Fuel for water heating, kWh/month	100.2260	88.3377	92.7699	83.1563	81.4862	72.8049	69.9157	76.7270	76.5940	86.2285	91.1852	97.8126	(219)
Water heating fuel used												1017.2440	(219)
Annual totals kWh/year													
Space heating fuel - main system												3570.8916	(211)
Space heating fuel - secondary												1369.7574	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Total delivered energy for all uses												6564.0275	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3570.8916	13.1900	471.0006	(240)
Space heating - secondary	1369.7574	4.2300	57.9407	(242)
Water heating (other fuel)	1017.2440	13.1900	134.1745	(247)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Energy for lighting	576.1345	13.1900	75.9921	(250)
Additional standing charges			0.0000	(251)
Total energy cost			743.0650	(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] = 1.3231 (257)
SAP value 81.5431
SAP rating (Section 12) 82 (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	3570.8916	0.5190	1853.2927	(261)
Space heating - secondary	1369.7574	0.0190	26.0254	(263)
Water heating (other fuel)	1017.2440	0.5190	527.9496	(264)
Space and water heating			2407.2678	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Total kg/year			2721.8516	(272)
CO2 emissions per m2			14.2600	(273)
EI value			84.5376	
EI rating			85	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency 13.19 x (1 + 0.29 x 0.25) / 2.2440 = 6.304, stars = 3
Main heating environmental impact 0.519 x (1 + 0.29 x 0.25) / 2.2440 = 0.2481, stars = 4
Water heating energy efficiency 13.19 / 2.2440 = 5.878, stars = 3

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.519 / 2.2440 = 0.2313$, stars = 4

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
Effective ac	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	239.8212	238.6932	238.6932	237.1045	237.1045	235.1787	235.6395	234.7317	235.1787	236.1141	236.1141	237.6203 (39)
Average = Sum(39)m / 12 =												236.8328 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2564	1.2505	1.2505	1.2422	1.2422	1.2321	1.2345	1.2297	1.2321	1.2370	1.2370	1.2449 (40)
HLP (average)												1.2407 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.8900	11.9814	0.6300	0.7000	0.7700	6.9206 (74)
East	21.3700	22.3313	0.6300	0.7000	0.7700	145.8447 (76)
South	2.4900	50.9848	0.6300	0.7000	0.7700	38.7982 (78)
West	11.4300	22.3313	0.6300	0.7000	0.7700	78.0068 (80)

Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284 (83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305 (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	55.2727	55.5339	55.5339	55.9060	55.9060	56.3637	56.2535	56.4711	56.3637	56.1405	56.1405	55.7846
alpha	4.6848	4.7023	4.7023	4.7271	4.7271	4.7576	4.7502	4.7647	4.7576	4.7427	4.7427	4.7190
util living area	0.9975	0.9946	0.9828	0.9340	0.8021	0.5499	0.3692	0.4078	0.7513	0.9628	0.9941	0.9981 (86)
MIT	19.9751	20.0904	20.3244	20.6184	20.8374	20.9301	20.9414	20.9407	20.8871	20.6014	20.2425	19.9602 (87)
Th 2	19.8751	19.8798	19.8798	19.8864	19.8864	19.8944	19.8925	19.8963	19.8944	19.8905	19.8905	19.8843 (88)
util rest of house	0.9966	0.9926	0.9762	0.9083	0.7319	0.4365	0.2384	0.2691	0.6450	0.9426	0.9914	0.9974 (89)
MIT 2	18.5165	18.6880	19.0267	19.4425	19.7139	19.8053	19.8087	19.8125	19.7764	19.4318	18.9188	18.5019 (90)
Living area fraction	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (91)
MIT	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7161	18.8800	19.2044	19.6034	19.8677	19.9593	19.9637	19.9670	19.9284	19.5919	19.1000	18.7015 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1139.0973	1318.8140	1522.1731	1675.5928	1463.7266	919.6548	485.8195	507.8295	1045.0379	1242.9320	1135.2905	1068.2972 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	3265.4391	3169.8460	2817.6273	2300.7270	1628.3727	931.1372	486.2985	508.6610	1112.0215	1887.0000	2620.8591	3231.9932 (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	1581.9983	1243.8935	963.8179	450.0966	122.4967	0.0000	0.0000	0.0000	0.0000	479.1866	1069.6094	1609.7899 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating 7520.8888 (98)
Space heating per m2 (98) / (4) = 39.4011 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													224.4000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													3016.3992 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1581.9983	1243.8935	963.8179	450.0966	122.4967	0.0000	0.0000	0.0000	0.0000	479.1866	1069.6094	1609.7899	(98)
Space heating efficiency (main heating system 1)	224.4000	224.4000	224.4000	224.4000	224.4000	0.0000	0.0000	0.0000	0.0000	224.4000	224.4000	224.4000	(210)
Space heating fuel (main heating system)	634.4913	498.8878	386.5580	180.5200	49.1297	0.0000	0.0000	0.0000	0.0000	192.1871	428.9877	645.6376	(211)
Water heating requirement	243.3844	191.3682	148.2797	69.2456	18.8456	0.0000	0.0000	0.0000	0.0000	73.7210	164.5553	247.6600	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	(216)
(217)m	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	(217)
Fuel for water heating, kWh/month	100.2260	88.3377	92.7699	83.1563	81.4862	72.8049	69.9157	76.7270	76.5940	86.2285	91.1852	97.8126	(219)
Water heating fuel used												1017.2440	(219)
Annual totals kWh/year													
Space heating fuel - main system												3016.3992	(211)
Space heating fuel - secondary												1157.0598	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Total delivered energy for all uses												5796.8376	(238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3016.3992	17.5600	529.6797 (240)
Space heating - secondary	1157.0598	4.6500	53.8033 (242)
Water heating (other fuel)	1017.2440	17.5600	178.6281 (247)
Pumps and fans for heating	30.0000	17.5600	5.2680 (249)
Energy for lighting	576.1345	17.5600	101.1692 (250)
Additional standing charges			0.0000 (251)
Total energy cost			868.5483 (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	3016.3992	0.5190	1565.5112 (261)
Space heating - secondary	1157.0598	0.0190	21.9841 (263)
Water heating (other fuel)	1017.2440	0.5190	527.9496 (264)
Space and water heating			2115.4450 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total kg/year			2430.0288 (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	3016.3992	3.0700	9260.3457 (261)
Space heating - secondary	1157.0598	1.0400	1203.3422 (263)
Water heating (other fuel)	1017.2440	3.0700	3122.9391 (264)
Space and water heating			13586.6271 (265)
Pumps and fans	30.0000	3.0700	92.1000 (267)
Energy for lighting	576.1345	3.0700	1768.7328 (268)
Primary energy kWh/year			15447.4599 (272)
Primary energy kWh/m2/year			80.9276 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 82
Current environmental impact rating: B 85

(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		Recommended
L2			Not considered
Q3			Not considered
O3			Not considered
Recommended measures:			
N	Solar water heating	SAP change + 1.2	Cost change -£ 67
U	Solar photovoltaic panels	+ 5.7	-£ 320
V2	Wind turbine	+ 11.7	-£ 628
		CO2 change	
			-198 kg (8.1%)
			-947 kg (42.4%)
			-1856 kg (144.4%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£67	1.04 kg/m²	B 83 B 86
Solar photovoltaic panels	£320	4.96 kg/m²	B 88 B 91
Wind turbine	£628	9.72 kg/m²	A 100 A 101
Total Savings	£1015	15.72 kg/m²	

Potential energy efficiency rating: A 100
Potential environmental impact rating: A 101

Fuel prices for cost data on this page from database revision number 445 TEST (30 Jul 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£815	£748	£67
Wood	£54	£54	-£0
Space heating	£589	£589	-£1
Water heating	£179	£111	£67
Lighting	£101	£101	£0
Generated (PV)	-£0	-£320	£320
Generated (wind)	-£0	-£628	£628
Total cost of fuels	£869	-£146	£1015
Total cost of uses	£869	-£147	£1014
Delivered energy	30 kWh/m²	0 kWh/m²	30 kWh/m²
Carbon dioxide emissions	2.4 tonnes	-0.6 tonnes	3.0 tonnes
CO2 emissions per m²	13 kg/m²	-3 kg/m²	16 kg/m²
Primary energy	81 kWh/m²	-12 kWh/m²	93 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
35.4385 (36)
(33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	245.5778	244.8831	244.2022	241.0041	240.4058	237.6203	237.6203	237.1045	238.6932	240.4058	241.6162	242.8817 (39)
Average = Sum(39)m / 12 =												241.0012 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2866	1.2829	1.2793	1.2626	1.2595	1.2449	1.2449	1.2422	1.2505	1.2595	1.2658	1.2724 (40)
HLP (average)												1.2626 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	206.7799	179.8491	170.0608	150.7676	143.8638	160.0790	166.4741	192.1011	204.6195	219.4915 (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												1.0956 (H8)
Utilisation factor												0.5986 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												0.7128 (H15)
Solar storage volume factor												0.9323 (H16)
Solar input												-889.9440 (H17)
Solar input	-25.8066	-43.0638	-73.3426	-98.2935	-121.4334	-119.3883	-117.8106	-102.9317	-80.6162	-55.0513	-30.6103	-21.5957 (63)
Solar input (sum of months) = Sum(63)m =												-889.9440 (63)
Output from w/h	199.1005	155.1661	133.4373	81.5555	48.6274	31.3792	26.0532	57.1473	85.8579	137.0498	174.0091	197.8958 (64)
Total per year (kWh/year) = Sum(64)m =												1327.2792 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	93.0082	80.7454	75.4702	68.3395	66.6510	72.4775	76.9297	88.1275	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	125.0110	112.1464	101.4385	94.9160	89.5846	97.4160	106.8468	118.4509	127.9707	131.5689	(72)
Total internal gains	875.0143	869.0762	834.8608	777.5824	717.6149	670.1863	643.2630	654.6022	691.7005	747.7184	806.4977	851.0021	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W
North					1.8900	10.6334	0.6300	0.7000				0.7700			6.1419 (74)
East					21.3700	19.6403	0.6300	0.7000				0.7700			128.2696 (76)
South					2.4900	46.7521	0.6300	0.7000				0.7700			35.5772 (78)
West					11.4300	19.6403	0.6300	0.7000				0.7700			68.6065 (80)
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294				197.7635 (83)
Total gains	1113.6096	1324.2114	1563.2833	1818.5303	1981.8389	1961.0067	1873.4308	1717.6864	1530.8800	1281.5270	1101.7271				1048.7656 (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	53.9770	54.1301	54.2811	55.0014	55.1383	55.7846	55.7846	55.9060	55.5339	55.1383	54.8620	54.5762
alpha	4.5985	4.6087	4.6187	4.6668	4.6759	4.7190	4.7190	4.7271	4.7023	4.6759	4.6575	4.6384
util living area	0.9982	0.9956	0.9871	0.9554	0.8696	0.7071	0.5418	0.6057	0.8534	0.9781	0.9963	0.9986 (86)
MIT	19.8646	19.9957	20.2210	20.5157	20.7566	20.8939	20.9315	20.9244	20.8189	20.4909	20.1247	19.8467 (87)
Th 2	19.8514	19.8542	19.8570	19.8703	19.8727	19.8843	19.8843	19.8864	19.8798	19.8727	19.8677	19.8625 (88)
util rest of house												
	0.9975	0.9941	0.9823	0.9381	0.8202	0.6098	0.4126	0.4733	0.7792	0.9666	0.9947	0.9982 (89)
MIT 2	18.3369	18.5303	18.8596	19.2885	19.6081	19.7684	19.7962	19.7951	19.6962	19.2629	18.7296	18.3192 (90)
Living area fraction									fLA =	Living area /	(4) =	0.1369 (91)

MIT	18.5460	18.7309	19.0460	19.4565	19.7653	19.9224	19.9516	19.9497	19.8499	19.4310	18.9206	18.5283 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5460	18.7309	19.0460	19.4565	19.7653	19.9224	19.9516	19.9497	19.8499	19.4310	18.9206	18.5283 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP band

A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3574.4179	0.5190	1855.1229 (261)
Space heating - secondary	1371.1100	0.0190	26.0511 (263)
Water heating (other fuel)	591.4791	0.5190	306.9777 (264)
Space and water heating			2188.1516 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-223.4575 (272)
CO2 emissions per m2			-1.1700 (273)
EI value			101.2694
EI rating			101 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2400	26.7000		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2400	11.1816		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.9294		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 151.3679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	239.8212	238.6932	238.6932	237.1045	237.1045	235.1787	235.6395	234.7317	235.1787	236.1141	236.1141	237.6203 (39)
Average = Sum(39)m / 12 =												236.8328 (39)
HLP	1.2564	1.2505	1.2505	1.2422	1.2422	1.2321	1.2345	1.2297	1.2321	1.2370	1.2370	1.2449 (40)
HLP (average)												1.2407 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	206.7799	179.8491	170.0608	150.7676	143.8638	160.0790	166.4741	192.1011	204.6195	219.4915 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1570 (H8)
Utilisation factor												0.5786 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												0.7128 (H15)
Solar storage volume factor												0.9323 (H16)
Solar input												-908.5616 (H17)
Solar input	-27.9651	-42.0314	-70.7863	-97.8483	-117.8423	-124.0239	-121.0458	-108.0946	-84.3682	-57.3941	-33.9923	-23.1692 (63)
Solar input (sum of months) = Sum(63)m =												-908.5616 (63)
Output from w/h	196.9420	156.1984	135.9936	82.0007	52.2185	26.7437	22.8180	51.9844	82.1058	134.7070	170.6272	196.3223 (64)
Total per year (kWh/year) = Sum(64)m =												1308.6616 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	93.0082	80.7454	75.4702	68.3395	66.6510	72.4775	76.9297	88.1275	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	125.0110	112.1464	101.4385	94.9160	89.5846	97.4160	106.8468	118.4509	127.9707	131.5689	(72)
Total internal gains	875.0143	869.0762	834.8608	777.5824	717.6149	670.1863	643.2630	654.6022	691.7005	747.7184	806.4977	851.0021	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				1.8900	11.9814		0.6300		0.7000		0.7700		6.9206 (74)	
East				21.3700	22.3313		0.6300		0.7000		0.7700		145.8447 (76)	
South				2.4900	50.9848		0.6300		0.7000		0.7700		38.7982 (78)	
West				11.4300	22.3313		0.6300		0.7000		0.7700		78.0068 (80)	
Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284 (83)		
Total gains	1144.5846	1332.0067	1566.4819	1853.7717	1989.7903	2059.8031	1953.4457	1813.2508	1604.9328	1327.4305	1148.2845	1072.2305 (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	55.2727	55.5339	55.5339	55.9060	55.9060	56.3637	56.2535	56.4711	56.3637	56.1405	56.1405	55.7846
alpha	4.6848	4.7023	4.7023	4.7271	4.7271	4.7576	4.7502	4.7647	4.7576	4.7427	4.7427	4.7190
util living area	0.9975	0.9946	0.9829	0.9348	0.8051	0.5532	0.3717	0.4106	0.7531	0.9630	0.9941	0.9981 (86)
MIT	19.9751	20.0904	20.3239	20.6164	20.8356	20.9297	20.9414	20.9407	20.8865	20.6009	20.2425	19.9602 (87)
Th 2	19.8751	19.8798	19.8798	19.8864	19.8864	19.8944	19.8925	19.8963	19.8944	19.8905	19.8905	19.8843 (88)
util rest of house	0.9966	0.9926	0.9763	0.9094	0.7353	0.4394	0.2401	0.2710	0.6469	0.9429	0.9914	0.9974 (89)
MIT 2	18.5165	18.6880	19.0260	19.4399	19.7122	19.8052	19.8087	19.8125	19.7759	19.4312	18.9188	18.5019 (90)
Living area fraction									fLA = Living area /	(4) =		0.1369 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

MIT	18.7161	18.8800	19.2037	19.6010	19.8660	19.9591	19.9637	19.9670	19.9280	19.5913	19.1000	18.7015 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7161	18.8800	19.2037	19.6010	19.8660	19.9591	19.9637	19.9670	19.9280	19.5913	19.1000	18.7015 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9901	0.9709	0.9013	0.7338	0.4463	0.2487	0.2800	0.6506	0.9355	0.9887	0.9963 (94)	
Useful gains	1139.0973	1318.8140	1520.8666	1670.8680	1460.1600	919.3002	485.8012	507.7985	1044.1296	1241.8228	1135.2905	1068.2972 (95)	
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)	
Heat loss rate W	3265.4391	3169.8460	2817.4654	2300.1433	1627.9500	931.0952	486.2956	508.6563	1111.9151	1886.8630	2620.8591	3231.9932 (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	1581.9983	1243.8935	964.6695	453.0782	124.8358	0.0000	0.0000	0.0000	0.0000	479.9099	1069.6094	1609.7899 (98)	
Space heating												7527.7844 (98)	
Space heating per m2												(98) / (4) = 39.4373 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													224.4000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													3019.1649 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1581.9983	1243.8935	964.6695	453.0782	124.8358	0.0000	0.0000	0.0000	0.0000	479.9099	1069.6094	1609.7899 (98)	
Space heating efficiency (main heating system 1)	224.4000	224.4000	224.4000	224.4000	224.4000	0.0000	0.0000	0.0000	0.0000	224.4000	224.4000	224.4000 (210)	
Space heating fuel (main heating system)	634.4913	498.8878	386.8995	181.7159	50.0678	0.0000	0.0000	0.0000	0.0000	192.4772	428.9877	645.6376 (211)	
Water heating requirement	243.3844	191.3682	148.4107	69.7043	19.2055	0.0000	0.0000	0.0000	0.0000	73.8323	164.5553	247.6600 (215)	
Water heating													
Water heating requirement	196.9420	156.1984	135.9936	82.0007	52.2185	26.7437	22.8180	51.9844	82.1058	134.7070	170.6272	196.3223 (64)	
Efficiency of water heater (217)m	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000 (216)	
Fuel for water heating, kWh/month	87.7638	69.6071	60.6032	36.5422	23.2703	11.9179	10.1684	23.1659	36.5890	60.0298	76.0371	87.4876 (219)	
Water heating fuel used												583.1825 (219)	
Annual totals kWh/year													
Space heating fuel - main system													3019.1649 (211)
Space heating fuel - secondary													1158.1207 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													80.0000 (231)
Electricity for lighting (calculated in Appendix L)													576.1345 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596				-1824.1596 (233)
Wind generation													-3575.5408 (234)
Total delivered energy for all uses													16.9022 (238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3019.1649	17.5600	530.1654 (240)	
Space heating - secondary	1158.1207	4.6500	53.8526 (242)	
Water heating (other fuel)	583.1825	17.5600	102.4069 (247)	
Pumps and fans for heating	30.0000	17.5600	5.2680 (249)	
Pump for solar water heating	50.0000	17.5600	8.7800 (249)	
Energy for lighting	576.1345	17.5600	101.1692 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1824.1596	17.5600	-320.3224 (252)	
Wind Turbine	-3575.5408	17.5600	-627.8650 (252)	
Total energy cost			-146.5454 (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	3019.1649	0.5190	1566.9466 (261)	
Space heating - secondary	1158.1207	0.0190	22.0043 (263)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Water heating (other fuel)	583.1825	0.5190	302.6717 (264)
Space and water heating			1891.6226 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-570.2881 (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	3019.1649	3.0700	9268.8361 (261)
Space heating - secondary	1158.1207	1.0400	1204.4455 (263)
Water heating (other fuel)	583.1825	3.0700	1790.3704 (264)
Space and water heating			12263.6520 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	576.1345	3.0700	1768.7328 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Wind Turbine	-3575.5408	3.0700	-10976.9101 (269)
Primary energy kWh/year			-2299.0953 (272)
Primary energy kWh/m2/year			-12.0447 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0669 V2			Issued on Date	16/07/2019
Assessment Reference	Rev F	Prop Type Ref			
Property					
SAP Rating	78 C	DER	18.06	TER	23.59
Environmental	82 B	% DER<TER	23.45		
CO ₂ Emissions (t/year)	2.91	DFEE	51.77	TFEE	61.71
General Requirements Compliance	Pass	% DFEE<TFEE	16.12		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com			Assessor ID	E477-0001
Client	HJ Concepts, HJC				

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

Detached House, total floor area 191 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:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 23.59 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 18.06 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)51.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (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: Heat pump with radiators or underfloor - Electric
Air-to-water heat pump

Secondary heating system: Room heaters - Wood Logs

Closed room heater

Efficiency: 65%

Minimum: 65% OK

5 Cylinder insulation

Hot water storage Nominal cylinder loss: 1.79 kWh/day

Permitted by DBSCG 2.30 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average

Windows facing North: 1.89 m², No overhang

Windows facing East: 21.37 m², No overhang

Windows facing South: 2.49 m², No overhang

Windows facing West: 11.43 m², Overhang twice as wide as window, ratio 1.88

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K

Roof U-value 0.10 W/m²K

Floor U-value 0.12 W/m²K

Door U-value 1.10 W/m²K

Window U-value 1.10 W/m²K

Secondary heating (wood logs)

Secondary heating fuel: wood logs

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																6 * 10 =	60.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000 / (5) =	0.1297 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3797 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3797 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)					
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)					

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	243.9994	243.3047	242.6238	239.4257	238.8274	236.0419	236.0419	235.5261	237.1148	238.8274	240.0378	241.3033 (39)
Average = Sum(39)m / 12 =												239.4228 (39)
HLP	Jan 1.2783	Feb 1.2746	Mar 1.2711	Apr 1.2543	May 1.2512	Jun 1.2366	Jul 1.2366	Aug 1.2339	Sep 1.2422	Oct 1.2512	Nov 1.2575	Dec 1.2642 (40)
HLP (average)												1.2543 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	Jan 115.7349	Feb 111.5263	Mar 107.3178	Apr 103.1092	May 98.9007	Jun 94.6922	Jul 94.6922	Aug 98.9007	Sep 103.1092	Oct 107.3178	Nov 111.5263	Dec 115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	599.7562	597.4377	577.5059	544.7514	510.3333	478.0559	457.6459	464.3649	481.6767	514.6716	552.6540	582.2573 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.8900	10.6334	0.6300	0.7000	0.7700		6.1419 (74)	
East					21.3700	19.6403	0.6300	0.7000	0.7700		128.2696 (76)	
South					2.4900	46.7521	0.6300	0.7000	0.7700		35.5772 (78)	
West					11.4300	19.6403	0.6300	0.7000	0.7700		68.6065 (80)	

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	838.3514	1052.5730	1305.9284	1585.6993	1774.5573	1768.8763	1687.8137	1527.4491	1320.8562	1048.4801	847.8834	780.0208 (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	21.7305	21.7925	21.8537	22.1456	22.2011	22.4631	22.4631	22.5123	22.3614	22.2011	22.0891	21.9733
alpha	2.4487	2.4528	2.4569	2.4764	2.4801	2.4975	2.4975	2.5008	2.4908	2.4801	2.4726	2.4649
util living area	0.9834	0.9706	0.9431	0.8840	0.7874	0.6558	0.5292	0.5844	0.7852	0.9284	0.9746	0.9861 (86)
MIT	18.7061	18.9424	19.3506	19.8788	20.3334	20.6538	20.7937	20.7628	20.4850	19.8677	19.1929	18.6733 (87)
Th 2	19.8579	19.8607	19.8636	19.8768	19.8793	19.8908	19.8908	19.8930	19.8864	19.8793	19.8742	19.8690 (88)
util rest of house	0.9806	0.9656	0.9332	0.8628	0.7460	0.5824	0.4219	0.4789	0.7270	0.9111	0.9695	0.9837 (89)
MIT 2	16.7702	17.1151	17.7071	18.4682	19.0957	19.5156	19.6692	19.6450	19.3186	18.4687	17.4911	16.7293 (90)
Living area fraction	17.0352	17.3652	17.9321	18.6613	19.2651	19.6714	19.8232	19.7980	19.4782	18.6602	17.7240	16.9954 (92)
MIT	17.0352	17.3652	17.9321	18.6613	19.2651	19.6714	19.8232	19.7980	19.4782	18.6602	17.7240	16.9954 (93)
Temperature adjustment												0.0000
adjusted MIT	17.0352	17.3652	17.9321	18.6613	19.2651	19.6714	19.8232	19.7980	19.4782	18.6602	17.7240	16.9954 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9701	0.9500	0.9102	0.8338	0.7190	0.5660	0.4147	0.4687	0.7009	0.8852	0.9552	0.9746 (94)
Ext temp.	813.3246	999.9472	1188.6700	1322.1777	1275.9578	1001.1287	699.9344	715.8561	925.7762	928.1590	809.8726	760.2260 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	3107.3729	3032.8509	2773.6967	2337.0963	1806.7594	1197.0567	760.7990	800.3130	1275.2627	1924.9877	2550.1734	3087.5812 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
	1706.7719	1366.1113	1179.2599	730.7414	394.9164	0.0000	0.0000	0.0000	0.0000	741.6406	1253.0166	1731.5522 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating 9104.0102 (98)
Space heating per m2 (98) / (4) = 47.6949 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													175.1000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													4679.3885 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1706.7719	1366.1113	1179.2599	730.7414	394.9164	0.0000	0.0000	0.0000	0.0000	741.6406	1253.0166	1731.5522	(98)
Space heating efficiency (main heating system 1)	175.1000	175.1000	175.1000	175.1000	175.1000	0.0000	0.0000	0.0000	0.0000	175.1000	175.1000	175.1000	(210)
Space heating fuel (main heating system)	877.2671	702.1703	606.1301	375.5952	202.9839	0.0000	0.0000	0.0000	0.0000	381.1973	644.0405	890.0040	(211)
Water heating requirement	262.5803	210.1710	181.4246	112.4218	60.7564	0.0000	0.0000	0.0000	0.0000	114.0985	192.7718	266.3927	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	128.4449	113.2095	118.8896	106.5692	104.4289	93.3034	89.6006	98.3298	98.1593	110.5065	116.8586	125.3521	(219)
Water heating fuel used												1303.6525	(219)
Annual totals kWh/year													
Space heating fuel - main system												4679.3885	(211)
Space heating fuel - secondary												1400.6170	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Total delivered energy for all uses												7989.7924	(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	4679.3885	0.5190	2428.6026	(261)
Space heating - secondary	1400.6170	0.0190	26.6117	(263)
Water heating (other fuel)	1303.6525	0.5190	676.5957	(264)
Space and water heating			3131.8100	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Total CO2, kg/year			3446.3938	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.0600	(273)

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

DER		18.0600	ZC1
Total Floor Area	TFA	190.8800	
Assumed number of occupants	N	2.9900	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		11.2472	ZC2
CO2 emissions from cooking, equation (L16)		0.9994	ZC3
Total CO2 emissions		30.3066	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.3066	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (Uw = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (56)												
If cylinder contains dedicated solar storage												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
223.3780 196.8488 206.6466 185.1230 181.3261 161.8946 155.3617 170.6464 170.3972 191.9678 203.1398 217.9625 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625 (64)
Total per year (kWh/year) = Sum(64)m =												2264.6926 (64)
Heat gains from water heating, kWh/month												
98.4647 87.3026 92.9015 84.9645 84.4824 77.2411 75.8493 80.9315 80.0682 88.0208 90.9551 96.6641 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
32.6231 28.9756 23.5645 17.8399 13.3355 11.2584 12.1651 15.8126 21.2237 26.9484 31.4527 33.5298 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
362.2933 366.0527 356.5790 336.4105 310.9514 287.0235 271.0381 267.2787 276.7524 296.9209 322.3800 346.3079 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 (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)													
-119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 (71)													
Water heating gains (Table 5)													
132.3451 129.9147 124.8677 118.0063 113.5517 107.2793 101.9480 108.7789 111.2059 118.3076 126.3266 129.9248 (72)													
Total internal gains	598.1121	595.7936	575.8618	543.1073	508.6892	476.4118	456.0018	462.7208	480.0326	513.0274	551.0099	580.6132 (73)	

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)
East	21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)
South	2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)
West	11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	836.7073	1050.9289	1304.2843	1584.0552	1772.9132	1767.2322	1686.1696	1525.8050	1319.2121	1046.8360	846.2392	778.3767 (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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001	
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000	
util living area	0.9995	0.9984	0.9936	0.9710	0.8970	0.7427	0.5757	0.6486	0.8949	0.9897	0.9988	0.9997 (86)	
MIT	19.5049	19.6800	19.9848	20.3878	20.7301	20.9271	20.9832	20.9711	20.8044	20.3367	19.8455	19.4795 (87)	
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054 (88)	
util rest of house													
0.9993 0.9978 0.9911 0.9591 0.8547 0.6489 0.4450 0.5155 0.8338 0.9838 0.9983 0.9995 (89)													
MIT 2	17.8906	18.1483	18.5943	19.1807	19.6434	19.8733	19.9165	19.9121	19.7520	19.1164	18.3982	17.8595 (90)	
Living area fraction													
MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (91)	
Temperature adjustment												0.0000	
adjusted MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9988 0.9965 0.9873 0.9507 0.8490 0.6580 0.4627 0.5331 0.8322 0.9787 0.9973 0.9992 (94)													
Useful gains	835.7296	1047.2189	1287.7359	1505.9743	1505.2837	1162.8179	780.2572	813.4162	1097.8307	1024.5788	843.9235	777.7367 (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													
3241.1589 3150.8497 2869.5702 2413.8371 1866.1266 1237.4841 790.9136 833.8799 1328.8209 2002.4784 2662.0772 3228.1329 (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	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948 (98)	
Space heating												9162.0152 (98)	
Space heating per m2												47.9988 (99)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													9798.9467 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1914.0529	1511.9144	1258.7002	699.1029	287.1306	0.0000	0.0000	0.0000	0.0000	778.1361	1400.0756	1949.8340	(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	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625	(64)
Efficiency of water heater (217)m	89.1732	89.0407	88.7231	87.8988	85.8590	79.8000	79.8000	79.8000	79.8000	88.0356	88.8987	89.2224	(216)
Fuel for water heating, kWh/month	250.4991	221.0774	232.9118	210.6092	211.1906	202.8754	194.6888	213.8427	213.5304	218.0569	228.5069	244.2911	(219)
Water heating fuel used												2642.0803	(219)
Annual totals kWh/year													
Space heating fuel - main system												9798.9467	(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)												576.1345	(232)
Total delivered energy for all uses												13092.1615	(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	9798.9467	0.2160	2116.5725 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2642.0803	0.2160	570.6893 (264)
Space and water heating			2687.2618 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total CO2, kg/m2/year			3025.2006 (272)
Emissions per m2 for space and water heating			14.0783 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.5665 (272b)
Emissions per m2 for pumps and fans			0.2039 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0783 * 1.55) + 1.5665 + 0.2039, rounded to 2 d.p.			23.5900 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.0865 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3365 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3365	(21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954	(22b)				
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	240.1573	239.6118	239.0772	236.5660	236.0961	233.9089	233.9089	233.5039	234.7514	236.0961	237.0466	238.0403 (39)
Average = Sum(39)m / 12 =												236.5637 (39)
HLP	1.2582	1.2553	1.2525	1.2393	1.2369	1.2254	1.2254	1.2233	1.2298	1.2369	1.2419	1.2471 (40)
HLP (average)												1.2393 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.8900	10.6334	0.6300	0.7000	0.7700		6.1419 (74)	
East					21.3700	19.6403	0.6300	0.7000	0.7700		128.2696 (76)	
South					2.4900	46.7521	0.6300	0.7000	0.7700		35.5772 (78)	
West					11.4300	19.6403	0.6300	0.7000	0.7700		68.6065 (80)	

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262 (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	22.0781	22.1284	22.1779	22.4133	22.4579	22.6679	22.6679	22.7072	22.5865	22.4579	22.3678	22.2745	
alpha	2.4719	2.4752	2.4785	2.4942	2.4972	2.5112	2.5112	2.5138	2.5058	2.4972	2.4912	2.4850	
util living area	0.9871	0.9755	0.9499	0.8936	0.7996	0.6707	0.5444	0.6027	0.8025	0.9387	0.9798	0.9894	(86)
MIT	18.0500	18.3669	18.9147	19.6205	20.2353	20.6683	20.8611	20.8161	20.4314	19.5925	18.6885	17.9996	(87)
Th 2	19.8738	19.8760	19.8782	19.8887	19.8906	19.8997	19.8997	19.9014	19.8962	19.8906	19.8867	19.8825	(88)
util rest of house	0.9849	0.9713	0.9411	0.8739	0.7597	0.5982	0.4366	0.4972	0.7470	0.9235	0.9758	0.9876	(89)
MIT 2	17.1663	17.4825	18.0256	18.7209	19.3025	19.6910	19.8372	19.8122	19.5009	18.7078	17.8118	17.1218	(90)
Living area fraction	17.2872	17.6035	18.1473	18.8441	19.4302	19.8248	19.9774	19.9496	19.6283	18.8289	17.9318	17.2420	(91)
MIT	17.2872	17.6035	18.1473	18.8441	19.4302	19.8248	19.9774	19.9496	19.6283	18.8289	17.9318	17.2420	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.2872	17.6035	18.1473	18.8441	19.4302	19.8248	19.9774	19.9496	19.6283	18.8289	17.9318	17.2420	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9774	0.9594	0.9229	0.8507	0.7403	0.5926	0.4449	0.5023	0.7307	0.9039	0.9654	0.9812	(94)
Ext temp.	733.4228	926.3270	1126.5351	1278.4877	1253.5446	1001.5147	716.7227	727.3822	906.4350	872.7905	735.7117	679.8987	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3118.9805	3043.9152	2784.6153	2352.4313	1825.0638	1222.1344	789.9961	828.8548	1297.7700	1942.8190	2567.6388	3104.5199	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1774.8549	1423.0193	1233.6116	773.2393	425.2102	0.0000	0.0000	0.0000	0.0000	796.1012	1318.9875	1803.9181	(98)
Space heating per m2												9548.9422	(98)
												50.0259	(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	2198.7438	1730.9259	1774.6294	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7010	0.7677	0.7264	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1541.3432	1328.8635	1289.1774	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	412.3296	512.8152	402.9018	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1328.0465 (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	103.0824	128.2038	100.7255	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												332.0116 (107)
Space cooling per m2												1.7394 (108)
Energy for space heating												50.0259 (99)
Energy for space cooling												1.7394 (108)
Total												51.7653 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (Uw = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North				1.8900	10.6334		0.6300	0.7000	0.7700	6.1419 (74)		
East				21.3700	19.6403		0.6300	0.7000	0.7700	128.2696 (76)		
South				2.4900	46.7521		0.6300	0.7000	0.7700	35.5772 (78)		
West				11.4300	19.6403		0.6300	0.7000	0.7700	68.6065 (80)		
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262 (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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001	
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000	
util living area	0.9997	0.9989	0.9951	0.9762	0.9102	0.7645	0.5988	0.6756	0.9127	0.9926	0.9993	0.9998	(86)
MIT	19.4631	19.6389	19.9453	20.3533	20.7062	20.9171	20.9802	20.9655	20.7808	20.2990	19.8048	19.4380	(87)
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054	(88)
util rest of house	0.9996	0.9985	0.9932	0.9661	0.8714	0.6719	0.4647	0.5405	0.8579	0.9883	0.9989	0.9997	(89)
MIT 2	18.4852	18.6626	18.9699	19.3799	19.7098	19.8835	19.9176	19.9141	19.7876	19.3324	18.8370	18.4671	(90)
Living area fraction									fLA = Living area / (4) =			0.1369	(91)
MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9994	0.9979	0.9913	0.9613	0.8685	0.6817	0.4831	0.5588	0.8582	0.9858	0.9985	0.9996	(94)
Ext temp.	749.9234	963.4251	1209.9958	1444.7370	1470.7292	1152.1055	778.2149	809.1015	1064.5675	951.8191	760.9442	692.6405	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3360.2576	3253.4532	2944.0321	2452.4675	1878.5794	1239.1841	791.0345	834.1019	1335.1239	2044.2913	2748.4918	3348.7675	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1942.0886	1538.8989	1290.1230	725.5659	303.4405	0.0000	0.0000	0.0000	0.0000	812.7993	1431.0343	1976.1585	(98)
Space heating per m2												10020.1090	(98)
												(98) / (4) =	52.4943 (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	2147.1638	1690.3204	1732.9265	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8231	0.8940	0.8517	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1767.3076	1511.1832	1476.0148	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	249.6352	377.1693	263.8947	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												890.6992 (104)
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	62.4088	94.2923	65.9737	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												222.6748 (107)
Space cooling per m2												1.1666 (108)
Energy for space heating												52.4943 (99)
Energy for space cooling												1.1666 (108)
Total												53.6609 (109)
Target Fabric Energy Efficiency (TFEE)												61.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
Effective ac	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	238.2428	237.1148	237.1148	235.5261	235.5261	233.6003	234.0611	233.1533	233.6003	234.5357	234.5357	236.0419 (39)
Average = Sum(39)m / 12 =												235.2544 (39)
HLP	1.2481	1.2422	1.2422	1.2339	1.2339	1.2238	1.2262	1.2215	1.2238	1.2287	1.2287	1.2366 (40)
HLP (average)												1.2325 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
RHI water heating demand												2283 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	(72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	(73)

6. Solar gains

[Jan]				Area	Solar flux	g		FF		Access		Gains	
				m2	Table 6a	W/m2		Specific data		Specific data		factor	
								or Table 6b		or Table 6c		Table 6d	
North				1.8900	11.9814			0.6300	0.7000			0.7700	6.9206 (74)
East				21.3700	22.3313			0.6300	0.7000			0.7700	145.8447 (76)
South				2.4900	50.9848			0.6300	0.7000			0.7700	38.7982 (78)
West				11.4300	22.3313			0.6300	0.7000			0.7700	78.0068 (80)
Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284	(83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305	(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	22.2555	22.3614	22.3614	22.5123	22.5123	22.6978	22.6531	22.7414	22.6978	22.6073	22.6073	22.4631
alpha	2.4837	2.4908	2.4908	2.5008	2.5008	2.5132	2.5102	2.5161	2.5132	2.5072	2.5072	2.4975
util living area	0.9637	0.9469	0.9073	0.8229	0.6921	0.4962	0.3492	0.3820	0.6512	0.8656	0.9443	0.9683 (86)
MIT	19.0694	19.2665	19.6665	20.1544	20.5535	20.7982	20.8669	20.8603	20.6840	20.1727	19.5506	19.0426 (87)
Th 2	19.8817	19.8864	19.8864	19.8930	19.8930	19.9010	19.8991	19.9029	19.9010	19.8971	19.8971	19.8908 (88)
util rest of house	0.9578	0.9383	0.8916	0.7924	0.6360	0.4064	0.2329	0.2612	0.5697	0.8348	0.9335	0.9631 (89)
MIT 2	17.3121	17.5991	18.1720	18.8582	19.3872	19.6762	19.7330	19.7336	19.5640	18.9033	18.0208	17.2796 (90)
Living area fraction									fLA = Living area / (4) =			0.1369 (91)
MIT	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9402	0.9166	0.8644	0.7640	0.6161	0.4001	0.2317	0.2595	0.5542	0.8057	0.9111	0.9470 (94)
Useful gains	1076.0931	1220.8923	1355.2921	1422.1007	1234.4649	829.7657	455.7783	473.8473	892.7878	1070.7179	1046.2149	1015.3998 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	2966.7542	2899.2788	2602.7151	2151.6715	1541.9577	894.6450	465.3653	486.7924	1055.2568	1753.6317	2399.3525	2931.8583 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	1406.6519	1127.8758	928.0827	525.2910	228.7746	0.0000	0.0000	0.0000	0.0000	508.0879	974.2591	1425.8452 (98)
RHI space heating demand												7124.8681 (98)
												7125 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	243.9994	243.3047	242.6238	239.4257	238.8274	236.0419	236.0419	235.5261	237.1148	238.8274	240.0378	241.3033 (39)
Average = Sum(39)m / 12 =												239.4228 (39)
HLP	1.2783	1.2746	1.2711	1.2543	1.2512	1.2366	1.2366	1.2339	1.2422	1.2512	1.2575	1.2642 (40)
HLP (average)												1.2543 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.8900	10.6334	0.6300	0.7000	0.7700		6.1419 (74)	
East					21.3700	19.6403	0.6300	0.7000	0.7700		128.2696 (76)	
South					2.4900	46.7521	0.6300	0.7000	0.7700		35.5772 (78)	
West					11.4300	19.6403	0.6300	0.7000	0.7700		68.6065 (80)	
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	1113.6096	1324.2114	1564.7841	1826.0343	1995.5962	1975.0142	1887.4383	1730.6933	1536.8832	1283.0278	1101.7271	1048.7656 (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	21.7305	21.7925	21.8537	22.1456	22.2011	22.4631	22.4631	22.5123	22.3614	22.2011	22.0891	21.9733
alpha	2.4487	2.4528	2.4569	2.4764	2.4801	2.4975	2.4975	2.5008	2.4908	2.4801	2.4726	2.4649
util living area	0.9693	0.9526	0.9192	0.8525	0.7497	0.6135	0.4867	0.5360	0.7355	0.8956	0.9558	0.9733 (86)
MIT	18.8775	19.1037	19.4899	19.9837	20.4003	20.6890	20.8110	20.7866	20.5484	19.9868	19.3463	18.8432 (87)
Th 2	19.8579	19.8607	19.8636	19.8768	19.8793	19.8908	19.8908	19.8930	19.8864	19.8793	19.8742	19.8690 (88)
util rest of house	0.9644	0.9451	0.9060	0.8275	0.7050	0.5397	0.3839	0.4334	0.6720	0.8724	0.9475	0.9690 (89)
MIT 2	17.0181	17.3468	17.9036	18.6099	19.1782	19.5511	19.6817	19.6636	19.3909	18.6316	17.7110	16.9755 (90)
Living area fraction	17.2726	17.5873	18.1207	18.7980	19.3455	19.7069	19.8363	19.8173	19.5494	18.8171	17.9349	17.2312 (92)
MIT	17.2726	17.5873	18.1207	18.7980	19.3455	19.7069	19.8363	19.8173	19.5494	18.8171	17.9349	17.2312 (93)
Temperature adjustment												0.0000
adjusted MIT	17.2726	17.5873	18.1207	18.7980	19.3455	19.7069	19.8363	19.8173	19.5494	18.8171	17.9349	17.2312 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1056.1325	1223.9667	1376.2671	1457.3289	1357.7127	1038.9663	714.3189	736.7352	998.0283	1082.5081	1021.7421	1001.0331 (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	3165.3166	3086.8760	2819.4672	2369.8288	1825.9604	1205.4358	763.9098	804.8694	1292.1269	1962.4726	2600.7755	3144.4717 (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	1569.2329	1251.8750	1073.7409	656.9999	348.3763	0.0000	0.0000	0.0000	0.0000	654.6936	1136.9041	1594.7183 (98)

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Space heating 8286.5411 (98)
Space heating per m2 (98) / (4) = 43.4123 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													175.1000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													4259.2159 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1569.2329	1251.8750	1073.7409	656.9999	348.3763	0.0000	0.0000	0.0000	0.0000	654.6936	1136.9041	1594.7183	(98)
Space heating efficiency (main heating system 1)	175.1000	175.1000	175.1000	175.1000	175.1000	0.0000	0.0000	0.0000	0.0000	175.1000	175.1000	175.1000	(210)
Space heating fuel (main heating system)	806.5732	643.4537	551.8942	337.6927	179.0626	0.0000	0.0000	0.0000	0.0000	336.5073	584.3596	819.6725	(211)
Water heating requirement	241.4205	192.5962	165.1909	101.0769	53.5964	0.0000	0.0000	0.0000	0.0000	100.7221	174.9083	245.3413	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(217)
Fuel for water heating, kWh/month	128.4449	113.2095	118.8896	106.5692	104.4289	93.3034	89.6006	98.3298	98.1593	110.5065	116.8586	125.3521	(219)
Water heating fuel used												1303.6525	(219)
Annual totals kWh/year													
Space heating fuel - main system												4259.2159	(211)
Space heating fuel - secondary												1274.8525	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Total delivered energy for all uses												7443.8553	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4259.2159	13.1900	561.7906 (240)
Space heating - secondary	1274.8525	4.2300	53.9263 (242)
Water heating (other fuel)	1303.6525	13.1900	171.9518 (247)
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)
Energy for lighting	576.1345	13.1900	75.9921 (250)
Additional standing charges			0.0000 (251)
Total energy cost			867.6177 (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] =	1.5449 (257)
SAP value	78.4493	
SAP rating (Section 12)	78	(258)
SAP band	C	

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	4259.2159	0.5190	2210.5330 (261)
Space heating - secondary	1274.8525	0.0190	24.2222 (263)
Water heating (other fuel)	1303.6525	0.5190	676.5957 (264)
Space and water heating			2911.3509 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total kg/year			3225.9347 (272)
CO2 emissions per m2			16.9000 (273)
EI value			81.6739
EI rating			82 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 x (1 + 0.29 x 0.25) / 1.7510 = 8.079, stars = 2
Main heating environmental impact	0.519 x (1 + 0.29 x 0.25) / 1.7510 = 0.3179, stars = 4
Water heating energy efficiency	13.19 / 1.7510 = 7.533, stars = 2

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.519 / 1.7510 = 0.2964$, stars = 4

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

100.0000 (35)
35.4385 (36)
(33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	238.2428	237.1148	237.1148	235.5261	235.5261	233.6003	234.0611	233.1533	233.6003	234.5357	234.5357	236.0419 (39)
Average = Sum(39)m / 12 =												235.2544 (39)
HLP	1.2481	1.2422	1.2422	1.2339	1.2339	1.2238	1.2262	1.2215	1.2238	1.2287	1.2287	1.2366 (40)
HLP (average)												1.2325 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss												
30.0132 27.1087 30.0132 29.0450 30.0132 29.0450 30.0132 30.0132 29.0450 30.0132 29.0450 30.0132 29.0450												30.0132 (56)
If cylinder contains dedicated solar storage												
30.0132 27.1087 30.0132 29.0450 30.0132 29.0450 30.0132 30.0132 29.0450 30.0132 29.0450 30.0132 29.0450												30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
224.9071 198.2299 208.1757 186.6027 182.8551 163.3743 156.8907 172.1755 171.8769 193.4968 204.6195 219.4915 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North					1.8900	11.9814	0.6300		0.7000		0.7700		6.9206 (74)
East					21.3700	22.3313	0.6300		0.7000		0.7700		145.8447 (76)
South					2.4900	50.9848	0.6300		0.7000		0.7700		38.7982 (78)
West					11.4300	22.3313	0.6300		0.7000		0.7700		78.0068 (80)
Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284	(83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305	(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	22.2555	22.3614	22.3614	22.5123	22.6978	22.6531	22.7414	22.6978	22.6073	22.6073	22.6073	22.4631
alpha	2.4837	2.4908	2.4908	2.5008	2.5008	2.5132	2.5102	2.5161	2.5132	2.5072	2.5072	2.4975
util living area	0.9637	0.9469	0.9073	0.8229	0.6921	0.4962	0.3492	0.3820	0.6512	0.8656	0.9443	0.9683 (86)
MIT	19.0694	19.2665	19.6665	20.1544	20.5535	20.7982	20.8669	20.8603	20.6840	20.1727	19.5506	19.0426 (87)
Th 2	19.8817	19.8864	19.8864	19.8930	19.8930	19.9010	19.8991	19.9029	19.9010	19.8971	19.8971	19.8908 (88)
util rest of house	0.9578	0.9383	0.8916	0.7924	0.6360	0.4064	0.2329	0.2612	0.5697	0.8348	0.9335	0.9631 (89)
MIT 2	17.3121	17.5991	18.1720	18.8582	19.3872	19.6762	19.7336	19.7336	19.5640	18.9033	18.0208	17.2796 (90)
Living area fraction	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209 (92)
MIT	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209 (93)
Temperature adjustment												0.0000
adjusted MIT	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1076.0931	1220.8923	1355.2921	1422.1007	1234.4649	829.7657	455.7783	473.8473	892.7878	1070.7179	1046.2149	1015.3998 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	2966.7542	2899.2788	2602.7151	2151.6715	1541.9577	894.6450	465.3653	486.7924	1055.2568	1753.6317	2399.3525	2931.8583 (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	1406.6519	1127.8758	928.0827	525.2910	228.7746	0.0000	0.0000	0.0000	0.0000	508.0879	974.2591	1425.8452 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating 7124.8681 (98)
Space heating per m2 (98) / (4) = 37.3264 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													175.1000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													3662.1252 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1406.6519	1127.8758	928.0827	525.2910	228.7746	0.0000	0.0000	0.0000	0.0000	508.0879	974.2591	1425.8452	(98)
Space heating efficiency (main heating system 1)	175.1000	175.1000	175.1000	175.1000	175.1000	0.0000	0.0000	0.0000	0.0000	175.1000	175.1000	175.1000	(210)
Space heating fuel (main heating system)	723.0078	579.7191	477.0271	269.9954	117.5883	0.0000	0.0000	0.0000	0.0000	261.1531	500.7614	732.8730	(211)
Water heating requirement	216.4080	173.5193	142.7820	80.8140	35.1961	0.0000	0.0000	0.0000	0.0000	78.1674	149.8860	219.3608	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(217)
Fuel for water heating, kWh/month	128.4449	113.2095	118.8896	106.5692	104.4289	93.3034	89.6006	98.3298	98.1593	110.5065	116.8586	125.3521	(219)
Water heating fuel used												1303.6525	(219)
Annual totals kWh/year													
Space heating fuel - main system												3662.1252	(211)
Space heating fuel - secondary												1096.1335	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Total delivered energy for all uses												6668.0458	(238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3662.1252	17.5600	643.0692 (240)
Space heating - secondary	1096.1335	4.6500	50.9702 (242)
Water heating (other fuel)	1303.6525	17.5600	228.9214 (247)
Pumps and fans for heating	30.0000	17.5600	5.2680 (249)
Energy for lighting	576.1345	17.5600	101.1692 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1029.3980 (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	3662.1252	0.5190	1900.6430 (261)
Space heating - secondary	1096.1335	0.0190	20.8265 (263)
Water heating (other fuel)	1303.6525	0.5190	676.5957 (264)
Space and water heating			2598.0652 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total kg/year			2912.6490 (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	3662.1252	3.0700	11242.7244 (261)
Space heating - secondary	1096.1335	1.0400	1139.9789 (263)
Water heating (other fuel)	1303.6525	3.0700	4002.2133 (264)
Space and water heating			16384.9166 (265)
Pumps and fans	30.0000	3.0700	92.1000 (267)
Energy for lighting	576.1345	3.0700	1768.7328 (268)
Primary energy kWh/year			18245.7494 (272)
Primary energy kWh/m2/year			95.5875 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: C 78
Current environmental impact rating: B 82

(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		Recommended
L2			Not considered
Q3			Not considered
O3			Not considered
Recommended measures:			
N	Solar water heating	SAP change + 1.6	Cost change -£ 88
U	Solar photovoltaic panels	+ 5.7	-£ 320
V2	Wind turbine	+ 11.7	-£ 628
		CO2 change	-261 kg (9.0%)
			-947 kg (35.7%)
			-1856 kg (108.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£88	1.37 kg/m²	C 80 B 83
Solar photovoltaic panels	£320	4.96 kg/m²	B 86 B 88
Wind turbine	£628	9.72 kg/m²	A 97 A 99
Total Savings	£1037	16.05 kg/m²	

Potential energy efficiency rating: A 97
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 445 TEST (30 Jul 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£978	£890	£88
Wood	£51	£51	-£0
Space heating	£699	£700	-£0
Water heating	£229	£140	£89
Lighting	£101	£101	£0
Generated (PV)	-£0	-£320	£320
Generated (wind)	-£0	-£628	£628
Total cost of fuels	£1029	-£7	£1036
Total cost of uses	£1029	-£7	£1037
Delivered energy	35 kWh/m²	4 kWh/m²	31 kWh/m²
Carbon dioxide emissions	2.9 tonnes	-0.2 tonnes	3.1 tonnes
CO2 emissions per m²	15 kg/m²	-1 kg/m²	16 kg/m²
Primary energy	96 kWh/m²	1 kWh/m²	95 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	243.9994	243.3047	242.6238	239.4257	238.8274	236.0419	236.0419	235.5261	237.1148	238.8274	240.0378	241.3033 (39)
Average = Sum(39)m / 12 =												239.4228 (39)
HLP	1.2783	1.2746	1.2711	1.2543	1.2512	1.2366	1.2366	1.2339	1.2422	1.2512	1.2575	1.2642 (40)
HLP (average)												1.2543 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	206.7799	179.8491	170.0608	150.7676	143.8638	160.0790	166.4741	192.1011	204.6195	219.4915 (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												1.0956 (H8)
Utilisation factor												0.5986 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												0.7128 (H15)
Solar storage volume factor												0.9323 (H16)
Solar input												-889.9440 (H17)
Solar input	-25.8066	-43.0638	-73.3426	-98.2935	-121.4334	-119.3883	-117.8106	-102.9317	-80.6162	-55.0513	-30.6103	-21.5957 (63)
Solar input (sum of months) = Sum(63)m =												-889.9440 (63)
Output from w/h	199.1005	155.1661	133.4373	81.5555	48.6274	31.3792	26.0532	57.1473	85.8579	137.0498	174.0091	197.8958 (64)
Total per year (kWh/year) = Sum(64)m =												1327.2792 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	93.0082	80.7454	75.4702	68.3395	66.6510	72.4775	76.9297	88.1275	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	125.0110	112.1464	101.4385	94.9160	89.5846	97.4160	106.8468	118.4509	127.9707	131.5689	(72)
Total internal gains	875.0143	869.0762	834.8608	777.5824	717.6149	670.1863	643.2630	654.6022	691.7005	747.7184	806.4977	851.0021	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W
North					1.8900	10.6334	0.6300	0.7000				0.7700			6.1419 (74)
East					21.3700	19.6403	0.6300	0.7000				0.7700			128.2696 (76)
South					2.4900	46.7521	0.6300	0.7000				0.7700			35.5772 (78)
West					11.4300	19.6403	0.6300	0.7000				0.7700			68.6065 (80)
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294				197.7635 (83)
Total gains	1113.6096	1324.2114	1563.2833	1818.5303	1981.8389	1961.0067	1873.4308	1717.6864	1530.8800	1281.5270	1101.7271				1048.7656 (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	21.7305	21.7925	21.8537	22.1456	22.2011	22.4631	22.4631	22.5123	22.3614	22.2011	22.0891	21.9733
alpha	2.4487	2.4528	2.4569	2.4764	2.4801	2.4975	2.4975	2.5008	2.4908	2.4801	2.4726	2.4649
util living area	0.9693	0.9526	0.9194	0.8535	0.7520	0.6163	0.4895	0.5389	0.7368	0.8958	0.9558	0.9733 (86)
MIT	18.8775	19.1037	19.4892	19.9806	20.3964	20.6869	20.8100	20.7853	20.5468	19.9861	19.3463	18.8432 (87)
Th 2	19.8579	19.8607	19.8636	19.8768	19.8793	19.8908	19.8908	19.8930	19.8864	19.8793	19.8742	19.8690 (88)
util rest of house	0.9644	0.9451	0.9062	0.8286	0.7075	0.5424	0.3864	0.4361	0.6735	0.8727	0.9475	0.9690 (89)
MIT 2	17.0181	17.3468	17.9025	18.6057	19.1735	19.5489	19.6810	19.6626	19.3891	18.6306	17.7110	16.9755 (90)
Living area fraction									fLA = Living area / (4) =			0.1369 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT	17.2726	17.5873	18.1197	18.7940	19.3409	19.7047	19.8355	19.8163	19.5476	18.8162	17.9349	17.2312 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2726	17.5873	18.1197	18.7940	19.3409	19.7047	19.8355	19.8163	19.5476	18.8162	17.9349	17.2312 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9484	0.9243	0.8797	0.7992	0.6827	0.5286	0.3808	0.4282	0.6507	0.8440	0.9274	0.9545 (94)	
Useful gains	1056.1325	1223.9667	1375.2301	1453.3480	1352.9782	1036.6380	713.4323	735.5682	996.2193	1081.5841	1021.7421	1001.0331 (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	3165.3166	3086.8760	2819.2136	2368.8675	1824.8563	1204.9242	763.7190	804.6164	1291.7089	1962.2482	2600.7755	3144.4717 (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	1569.2329	1251.8750	1074.3237	659.1741	351.0774	0.0000	0.0000	0.0000	0.0000	655.2141	1136.9041	1594.7183 (98)	
Space heating												8292.5196 (98)	
Space heating per m2												(98) / (4) = 43.4436 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													175.1000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													4262.2888 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1569.2329	1251.8750	1074.3237	659.1741	351.0774	0.0000	0.0000	0.0000	0.0000	655.2141	1136.9041	1594.7183 (98)	
Space heating efficiency (main heating system 1)	175.1000	175.1000	175.1000	175.1000	175.1000	0.0000	0.0000	0.0000	0.0000	175.1000	175.1000	175.1000 (210)	
Space heating fuel (main heating system)	806.5732	643.4537	552.1938	338.8102	180.4510	0.0000	0.0000	0.0000	0.0000	336.7748	584.3596	819.6725 (211)	
Water heating requirement	241.4205	192.5962	165.2806	101.4114	54.0119	0.0000	0.0000	0.0000	0.0000	100.8022	174.9083	245.3413 (215)	
Water heating													
Water heating requirement	199.1005	155.1661	133.4373	81.5555	48.6274	31.3792	26.0532	57.1473	85.8579	137.0498	174.0091	197.8958 (64)	
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)	
Fuel for water heating, kWh/month	113.7067	88.6157	76.2064	46.5765	27.7712	17.9207	14.8790	32.6370	49.0336	78.2694	99.3770	113.0187 (219)	
Water heating fuel used												758.0121 (219)	
Annual totals kWh/year													
Space heating fuel - main system													4262.2888 (211)
Space heating fuel - secondary													1275.7722 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													80.0000 (231)
Electricity for lighting (calculated in Appendix L)													576.1345 (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)
Wind generation													-3575.5408 (234)
Total delivered energy for all uses													1649.4274 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4262.2888	13.1900	562.1959 (240)	
Space heating - secondary	1275.7722	4.2300	53.9652 (242)	
Water heating (other fuel)	758.0121	13.1900	99.9818 (247)	
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)	
Pump for solar water heating	50.0000	13.1900	6.5950 (249)	
Energy for lighting	576.1345	13.1900	75.9921 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229 (252)	
Wind Turbine	-3575.5408	13.1900	-471.6138 (252)	
Total energy cost			103.2503 (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] =	0.1838 (257)
SAP value			97.4354
SAP rating (Section 12)			97 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP band

A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4262.2888	0.5190	2212.1279	(261)
Space heating - secondary	1275.7722	0.0190	24.2397	(263)
Water heating (other fuel)	758.0121	0.5190	393.4083	(264)
Space and water heating			2629.7758	(265)
Pumps and fans	80.0000	0.5190	41.5200	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Wind Turbine	-3575.5408	0.5190	-1855.7056	(269)
Total kg/year			218.1667	(272)
CO2 emissions per m2			1.1400	(273)
EI value			98.7606	
EI rating			99	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
Effective ac	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	238.2428	237.1148	237.1148	235.5261	235.5261	233.6003	234.0611	233.1533	233.6003	234.5357	234.5357	236.0419 (39)
Average = Sum(39)m / 12 =												235.2544 (39)
HLP	1.2481	1.2422	1.2422	1.2339	1.2339	1.2238	1.2262	1.2215	1.2238	1.2287	1.2287	1.2366 (40)
HLP (average)												1.2325 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	206.7799	179.8491	170.0608	150.7676	143.8638	160.0790	166.4741	192.1011	204.6195	219.4915 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1570 (H8)
Utilisation factor												0.5786 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												0.7128 (H15)
Solar storage volume factor												0.9323 (H16)
Solar input												-908.5616 (H17)
Solar input	-27.9651	-42.0314	-70.7863	-97.8483	-117.8423	-124.0239	-121.0458	-108.0946	-84.3682	-57.3941	-33.9923	-23.1692 (63)
Solar input (sum of months) = Sum(63)m =												-908.5616 (63)
Output from w/h	196.9420	156.1984	135.9936	82.0007	52.2185	26.7437	22.8180	51.9844	82.1058	134.7070	170.6272	196.3223 (64)
Total per year (kWh/year) = Sum(64)m =												1308.6616 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	93.0082	80.7454	75.4702	68.3395	66.6510	72.4775	76.9297	88.1275	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	125.0110	112.1464	101.4385	94.9160	89.5846	97.4160	106.8468	118.4509	127.9707	131.5689	(72)
Total internal gains	875.0143	869.0762	834.8608	777.5824	717.6149	670.1863	643.2630	654.6022	691.7005	747.7184	806.4977	851.0021	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W	
North					1.8900	11.9814	0.6300	0.7000			0.7700			6.9206 (74)	
East					21.3700	22.3313	0.6300	0.7000			0.7700			145.8447 (76)	
South					2.4900	50.9848	0.6300	0.7000			0.7700			38.7982 (78)	
West					11.4300	22.3313	0.6300	0.7000			0.7700			78.0068 (80)	

Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867			221.2284 (83)	
Total gains	1144.5846	1332.0067	1566.4819	1853.7717	1989.7903	2059.8031	1953.4457	1813.2508	1604.9328	1327.4305	1148.2845	1072.2305			(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.2555	22.3614	22.3614	22.5123	22.5123	22.6978	22.6531	22.7414	22.6978	22.6073	22.6073	22.4631	
alpha	2.4837	2.4908	2.4908	2.5008	2.5008	2.5132	2.5102	2.5161	2.5132	2.5072	2.5072	2.4975	
util living area	0.9637	0.9469	0.9074	0.8241	0.6946	0.4987	0.3514	0.3843	0.6526	0.8658	0.9443	0.9683	(86)
MIT	19.0694	19.2665	19.6658	20.1516	20.5504	20.7971	20.8665	20.8598	20.6829	20.1720	19.5506	19.0426	(87)
Th 2	19.8817	19.8864	19.8864	19.8930	19.8930	19.9010	19.8991	19.9029	19.9010	19.8971	19.8971	19.8908	(88)
util rest of house	0.9578	0.9383	0.8918	0.7936	0.6387	0.4087	0.2345	0.2630	0.5712	0.8351	0.9335	0.9631	(89)
MIT 2	17.3121	17.5991	18.1710	18.8545	19.3837	19.6753	19.7328	19.7334	19.5630	18.9024	18.0208	17.2796	(90)
Living area fraction									fLA = Living area / (4) =				0.1369 (91)

MIT	17.5527	17.8273	18.3756	19.0321	19.5434	19.8289	19.8880	19.8876	19.7163	19.0762	18.2302	17.5209 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5527	17.8273	18.3756	19.0321	19.5434	19.8289	19.8880	19.8876	19.7163	19.0762	18.2302	17.5209 (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

Water heating (other fuel)	747.3796	0.5190	387.8900 (264)
Space and water heating			2310.7107 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-151.2000 (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	3664.7004	3.0700	11250.6302 (261)
Space heating - secondary	1096.9043	1.0400	1140.7805 (263)
Water heating (other fuel)	747.3796	3.0700	2294.4552 (264)
Space and water heating			14685.8660 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	576.1345	3.0700	1768.7328 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Wind Turbine	-3575.5408	3.0700	-10976.9101 (269)
Primary energy kWh/year			123.1186 (272)
Primary energy kWh/m2/year			0.6450 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0669 V2			Issued on Date	16/07/2019
Assessment Reference	Rev G	Prop Type Ref			
Property					
SAP Rating	82 B	DER	14.48	TER	23.59
Environmental	85 B	% DER<TER	38.62		
CO ₂ Emissions (t/year)	2.35	DFEE	51.77	TFEE	61.71
General Requirements Compliance	Pass	% DFEE<TFEE	16.12		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com			Assessor ID	E477-0001
Client	HJ Concepts, HJC				

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

Detached House, total floor area 191 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:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 23.59 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.48 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)51.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (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: Heat pump with radiators or underfloor - Electric

Ground-to-water heat pump

Secondary heating system: Room heaters - Wood Logs

Closed room heater

Efficiency: 65%

Minimum: 65% OK

5 Cylinder insulation

Hot water storage Nominal cylinder loss: 1.79 kWh/day

Permitted by DBSCG 2.30 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North: 1.89 m², No overhang
Windows facing East: 21.37 m², No overhang
Windows facing South: 2.49 m², No overhang
Windows facing West: 11.43 m², Overhang twice as wide as window, ratio 1.88
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Window U-value 1.10 W/m²K
Secondary heating (wood logs)
Secondary heating fuel: wood logs

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																6 * 10 =	60.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000	/ (5) =	0.1297 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3797 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3797	(21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462	(22b)				
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	243.9994	243.3047	242.6238	239.4257	238.8274	236.0419	236.0419	235.5261	237.1148	238.8274	240.0378	241.3033 (39)
Average = Sum(39)m / 12 =												239.4228 (39)
HLP	Jan 1.2783	Feb 1.2746	Mar 1.2711	Apr 1.2543	May 1.2512	Jun 1.2366	Jul 1.2366	Aug 1.2339	Sep 1.2422	Oct 1.2512	Nov 1.2575	Dec 1.2642 (40)
HLP (average)												1.2543 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	Jan 115.7349	Feb 111.5263	Mar 107.3178	Apr 103.1092	May 98.9007	Jun 94.6922	Jul 94.6922	Aug 98.9007	Sep 103.1092	Oct 107.3178	Nov 111.5263	Dec 115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	599.7562	597.4377	577.5059	544.7514	510.3333	478.0559	457.6459	464.3649	481.6767	514.6716	552.6540	582.2573 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.8900	10.6334		0.6300		0.7000		0.7700		6.1419 (74)
East				21.3700	19.6403		0.6300		0.7000		0.7700		128.2696 (76)
South				2.4900	46.7521		0.6300		0.7000		0.7700		35.5772 (78)
West				11.4300	19.6403		0.6300		0.7000		0.7700		68.6065 (80)
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294		197.7635 (83)
Total gains	838.3514	1052.5730	1305.9284	1585.6993	1774.5573	1768.8763	1687.8137	1527.4491	1320.8562	1048.4801	847.8834		780.0208 (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	21.7305	21.7925	21.8537	22.1456	22.2011	22.4631	22.4631	22.5123	22.3614	22.2011	22.0891	21.9733
alpha	2.4487	2.4528	2.4569	2.4764	2.4801	2.4975	2.4975	2.5008	2.4908	2.4801	2.4726	2.4649
util living area	0.9834	0.9706	0.9431	0.8840	0.7874	0.6558	0.5292	0.5844	0.7852	0.9284	0.9746	0.9861 (86)
MIT	18.7061	18.9424	19.3506	19.8788	20.3334	20.6538	20.7937	20.7628	20.4850	19.8677	19.1929	18.6733 (87)
Th 2	19.8579	19.8607	19.8636	19.8768	19.8793	19.8908	19.8908	19.8930	19.8864	19.8793	19.8742	19.8690 (88)
util rest of house	0.9806	0.9656	0.9332	0.8628	0.7460	0.5824	0.4219	0.4789	0.7270	0.9111	0.9695	0.9837 (89)
MIT 2	16.7702	17.1151	17.7071	18.4682	19.0957	19.5156	19.6692	19.6450	19.3186	18.4687	17.4911	16.7293 (90)
Living area fraction	17.0352	17.3652	17.9321	18.6613	19.2651	19.6714	19.8232	19.7980	19.4782	18.6602	17.7240	16.9954 (92)
MIT	17.0352	17.3652	17.9321	18.6613	19.2651	19.6714	19.8232	19.7980	19.4782	18.6602	17.7240	16.9954 (93)
Temperature adjustment												0.0000
adjusted MIT	17.0352	17.3652	17.9321	18.6613	19.2651	19.6714	19.8232	19.7980	19.4782	18.6602	17.7240	16.9954 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	813.3246	999.9472	1188.6700	1322.1777	1275.9578	1001.1287	699.9344	715.8561	925.7762	928.1590	809.8726	760.2260 (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	3107.3729	3032.8509	2773.6967	2337.0963	1806.7594	1197.0567	760.7990	800.3130	1275.2627	1924.9877	2550.1734	3087.5812 (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	1706.7719	1366.1113	1179.2599	730.7414	394.9164	0.0000	0.0000	0.0000	0.0000	741.6406	1253.0166	1731.5522 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating 9104.0102 (98)
Space heating per m2 (98) / (4) = 47.6949 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													224.4000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													3651.3410 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1706.7719	1366.1113	1179.2599	730.7414	394.9164	0.0000	0.0000	0.0000	0.0000	741.6406	1253.0166	1731.5522	(98)
Space heating efficiency (main heating system 1)	224.4000	224.4000	224.4000	224.4000	224.4000	0.0000	0.0000	0.0000	0.0000	224.4000	224.4000	224.4000	(210)
Space heating fuel (main heating system)	684.5342	547.9056	472.9652	293.0781	158.3889	0.0000	0.0000	0.0000	0.0000	297.4494	502.5467	694.4728	(211)
Water heating requirement	262.5803	210.1710	181.4246	112.4218	60.7564	0.0000	0.0000	0.0000	0.0000	114.0985	192.7718	266.3927	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	(216)
Fuel for water heating, kWh/month	100.2260	88.3377	92.7699	83.1563	81.4862	72.8049	69.9157	76.7270	76.5940	86.2285	91.1852	97.8126	(219)
Water heating fuel used												1017.2440	(219)
Annual totals kWh/year													
Space heating fuel - main system												3651.3410	(211)
Space heating fuel - secondary												1400.6170	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Total delivered energy for all uses												6675.3364	(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	3651.3410	0.5190	1895.0460	(261)
Space heating - secondary	1400.6170	0.0190	26.6117	(263)
Water heating (other fuel)	1017.2440	0.5190	527.9496	(264)
Space and water heating			2449.6073	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Total CO2, kg/year			2764.1911	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.4800	(273)

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

DER		14.4800	ZC1
Total Floor Area	TFA	190.8800	
Assumed number of occupants	N	2.9900	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		11.2472	ZC2
CO2 emissions from cooking, equation (L16)		0.9994	ZC3
Total CO2 emissions		26.7266	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.7266	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (Uw = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (56)												
If cylinder contains dedicated solar storage												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
223.3780 196.8488 206.6466 185.1230 181.3261 161.8946 155.3617 170.6464 170.3972 191.9678 203.1398 217.9625 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625 (64)
Total per year (kWh/year) = Sum(64)m =												2264.6926 (64)
Heat gains from water heating, kWh/month												
98.4647 87.3026 92.9015 84.9645 84.4824 77.2411 75.8493 80.9315 80.0682 88.0208 90.9551 96.6641 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
32.6231 28.9756 23.5645 17.8399 13.3355 11.2584 12.1651 15.8126 21.2237 26.9484 31.4527 33.5298 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
362.2933 366.0527 356.5790 336.4105 310.9514 287.0235 271.0381 267.2787 276.7524 296.9209 322.3800 346.3079 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 (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)												
-119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 (71)												
Water heating gains (Table 5)												
132.3451 129.9147 124.8677 118.0063 113.5517 107.2793 101.9480 108.7789 111.2059 118.3076 126.3266 129.9248 (72)												
Total internal gains	598.1121	595.7936	575.8618	543.1073	508.6892	476.4118	456.0018	462.7208	480.0326	513.0274	551.0099	580.6132 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)
East	21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)
South	2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)
West	11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	836.7073	1050.9289	1304.2843	1584.0552	1772.9132	1767.2322	1686.1696	1525.8050	1319.2121	1046.8360	846.2392	778.3767 (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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000
util living area	0.9995	0.9984	0.9936	0.9710	0.8970	0.7427	0.5757	0.6486	0.8949	0.9897	0.9988	0.9997 (86)
MIT	19.5049	19.6800	19.9848	20.3878	20.7301	20.9271	20.9832	20.9711	20.8044	20.3367	19.8455	19.4795 (87)
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054 (88)
util rest of house												
0.9993 0.9978 0.9911 0.9591 0.8547 0.6489 0.4450 0.5155 0.8338 0.9838 0.9983 0.9995 (89)												
MIT 2	17.8906	18.1483	18.5943	19.1807	19.6434	19.8733	19.9165	19.9121	19.7520	19.1164	18.3982	17.8595 (90)
Living area fraction									fLA = Living area / (4) =			0.1369 (91)
MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9988 0.9965 0.9873 0.9507 0.8490 0.6580 0.4627 0.5331 0.8322 0.9787 0.9973 0.9992 (94)												
Useful gains	835.7296	1047.2189	1287.7359	1505.9743	1505.2837	1162.8179	780.2572	813.4162	1097.8307	1024.5788	843.9235	777.7367 (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												
3241.1589 3150.8497 2869.5702 2413.8371 1866.1266 1237.4841 790.9136 833.8799 1328.8209 2002.4784 2662.0772 3228.1329 (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	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948 (98)
Space heating												9162.0152 (98)
Space heating per m2												(98) / (4) = 47.9988 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													9798.9467	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948	(98)	
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)	
Space heating fuel (main heating system)	1914.0529	1511.9144	1258.7002	699.1029	287.1306	0.0000	0.0000	0.0000	0.0000	778.1361	1400.0756	1949.8340	(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	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625	(64)	
Efficiency of water heater (217)m	89.1732	89.0407	88.7231	87.8988	85.8590	79.8000	79.8000	79.8000	79.8000	88.0356	88.8987	89.2224	(216)	
Fuel for water heating, kWh/month	250.4991	221.0774	232.9118	210.6092	211.1906	202.8754	194.6888	213.8427	213.5304	218.0569	228.5069	244.2911	(219)	
Water heating fuel used												2642.0803	(219)	
Annual totals kWh/year														
Space heating fuel - main system												9798.9467	(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)													576.1345	(232)
Total delivered energy for all uses													13092.1615	(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	9798.9467	0.2160	2116.5725 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2642.0803	0.2160	570.6893 (264)
Space and water heating			2687.2618 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total CO2, kg/m2/year			3025.2006 (272)
Emissions per m2 for space and water heating			14.0783 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.5665 (272b)
Emissions per m2 for pumps and fans			0.2039 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0783 * 1.55) + 1.5665 + 0.2039, rounded to 2 d.p.			23.5900 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	240.1573	239.6118	239.0772	236.5660	236.0961	233.9089	233.9089	233.5039	234.7514	236.0961	237.0466	238.0403 (39)
Average = Sum(39)m / 12 =												236.5637 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2582	1.2553	1.2525	1.2393	1.2369	1.2254	1.2254	1.2233	1.2298	1.2369	1.2419	1.2471 (40)
HLP (average)												1.2393 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

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Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North					1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)				
East					21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)				
South					2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)				
West					11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)				

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635	(83)	
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262	(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	22.0781	22.1284	22.1779	22.4133	22.4579	22.6679	22.6679	22.7072	22.5865	22.4579	22.3678	22.2745	
alpha	2.4719	2.4752	2.4785	2.4942	2.4972	2.5112	2.5112	2.5138	2.5058	2.4972	2.4912	2.4850	
util living area	0.9871	0.9755	0.9499	0.8936	0.7996	0.6707	0.5444	0.6027	0.8025	0.9387	0.9798	0.9894	(86)
MIT	18.0500	18.3669	18.9147	19.6205	20.2353	20.6683	20.8611	20.8161	20.4314	19.5925	18.6885	17.9996	(87)
Th 2	19.8738	19.8760	19.8782	19.8887	19.8906	19.8997	19.8997	19.9014	19.8962	19.8906	19.8867	19.8825	(88)
util rest of house	0.9849	0.9713	0.9411	0.8739	0.7597	0.5982	0.4366	0.4972	0.7470	0.9235	0.9758	0.9876	(89)
MIT 2	17.1663	17.4825	18.0256	18.7209	19.3025	19.6910	19.8372	19.8122	19.5009	18.7078	17.8118	17.1218	(90)
Living area fraction	17.2872	17.6035	18.1473	18.8441	19.4302	19.8248	19.9774	19.9496	19.6283	18.8289	17.9318	17.2420	(91)
MIT	17.2872	17.6035	18.1473	18.8441	19.4302	19.8248	19.9774	19.9496	19.6283	18.8289	17.9318	17.2420	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.2872	17.6035	18.1473	18.8441	19.4302	19.8248	19.9774	19.9496	19.6283	18.8289	17.9318	17.2420	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9774	0.9594	0.9229	0.8507	0.7403	0.5926	0.4449	0.5023	0.7307	0.9039	0.9654	0.9812	(94)
Ext temp.	733.4228	926.3270	1126.5351	1278.4877	1253.5446	1001.5147	716.7227	727.3822	906.4350	872.7905	735.7117	679.8987	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3118.9805	3043.9152	2784.6153	2352.4313	1825.0638	1222.1344	789.9961	828.8548	1297.7700	1942.8190	2567.6388	3104.5199	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1774.8549	1423.0193	1233.6116	773.2393	425.2102	0.0000	0.0000	0.0000	0.0000	796.1012	1318.9875	1803.9181	(98)
Space heating per m2												9548.9422	(98)
												50.0259	(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	2198.7438	1730.9259	1774.6294	0.0000	0.0000	0.0000	0.0000	(100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7010	0.7677	0.7264	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1541.3432	1328.8635	1289.1774	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	412.3296	512.8152	402.9018	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1328.0465 (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	103.0824	128.2038	100.7255	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												332.0116 (107)
Space cooling per m2												1.7394 (108)
Energy for space heating												50.0259 (99)
Energy for space cooling												1.7394 (108)
Total												51.7653 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.8 (109)

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (U _w = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements A _{um} (A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North					1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)			
East					21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)			
South					2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)			
West					11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)			

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635	(83)
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262	(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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001	
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000	
util living area	0.9997	0.9989	0.9951	0.9762	0.9102	0.7645	0.5988	0.6756	0.9127	0.9926	0.9993	0.9998	(86)
MIT	19.4631	19.6389	19.9453	20.3533	20.7062	20.9171	20.9802	20.9655	20.7808	20.2990	19.8048	19.4380	(87)
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054	(88)
util rest of house	0.9996	0.9985	0.9932	0.9661	0.8714	0.6719	0.4647	0.5405	0.8579	0.9883	0.9989	0.9997	(89)
MIT 2	18.4852	18.6626	18.9699	19.3799	19.7098	19.8835	19.9176	19.9141	19.7876	19.3324	18.8370	18.4671	(90)
Living area fraction									fLA = Living area / (4) =			0.1369	(91)
MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9994	0.9979	0.9913	0.9613	0.8685	0.6817	0.4831	0.5588	0.8582	0.9858	0.9985	0.9996	(94)
Ext temp.	749.9234	963.4251	1209.9958	1444.7370	1470.7292	1152.1055	778.2149	809.1015	1064.5675	951.8191	760.9442	692.6405	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3360.2576	3253.4532	2944.0321	2452.4675	1878.5794	1239.1841	791.0345	834.1019	1335.1239	2044.2913	2748.4918	3348.7675	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1942.0886	1538.8989	1290.1230	725.5659	303.4405	0.0000	0.0000	0.0000	0.0000	812.7993	1431.0343	1976.1585	(98)
Space heating per m2												10020.1090	(98)
												(98) / (4) =	52.4943 (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	2147.1638	1690.3204	1732.9265	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8231	0.8940	0.8517	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1767.3076	1511.1832	1476.0148	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	249.6352	377.1693	263.8947	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												890.6992 (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	62.4088	94.2923	65.9737	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												222.6748 (107)
Space cooling per m2												1.1666 (108)
Energy for space heating												52.4943 (99)
Energy for space cooling												1.1666 (108)
Total												53.6609 (109)
Target Fabric Energy Efficiency (TFEE)												61.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
Effective ac	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	238.2428	237.1148	237.1148	235.5261	235.5261	233.6003	234.0611	233.1533	233.6003	234.5357	234.5357	236.0419 (39)
Average = Sum(39)m / 12 =												235.2544 (39)
HLP	1.2481	1.2422	1.2422	1.2339	1.2339	1.2238	1.2262	1.2215	1.2238	1.2287	1.2287	1.2366 (40)
HLP (average)												1.2325 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
RHI water heating demand												2283 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	(72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.8900	11.9814	0.6300	0.7000	0.7700	6.9206 (74)			
East				21.3700	22.3313	0.6300	0.7000	0.7700	145.8447 (76)			
South				2.4900	50.9848	0.6300	0.7000	0.7700	38.7982 (78)			
West				11.4300	22.3313	0.6300	0.7000	0.7700	78.0068 (80)			
Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284 (83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305 (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	22.2555	22.3614	22.3614	22.5123	22.5123	22.6978	22.6531	22.7414	22.6978	22.6073	22.6073	22.4631	
alpha	2.4837	2.4908	2.4908	2.5008	2.5008	2.5132	2.5102	2.5161	2.5132	2.5072	2.5072	2.4975	
util living area	0.9637	0.9469	0.9073	0.8229	0.6921	0.4962	0.3492	0.3820	0.6512	0.8656	0.9443	0.9683	(86)
MIT	19.0694	19.2665	19.6665	20.1544	20.5535	20.7982	20.8669	20.8603	20.6840	20.1727	19.5506	19.0426	(87)
Th 2	19.8817	19.8864	19.8864	19.8930	19.8930	19.9010	19.8991	19.9029	19.9010	19.8971	19.8971	19.8908	(88)
util rest of house	0.9578	0.9383	0.8916	0.7924	0.6360	0.4064	0.2329	0.2612	0.5697	0.8348	0.9335	0.9631	(89)
MIT 2	17.3121	17.5991	18.1720	18.8582	19.3872	19.6762	19.7330	19.7336	19.5640	18.9033	18.0208	17.2796	(90)
Living area fraction									fLA = Living area / (4) =			0.1369	(91)
MIT	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9402	0.9166	0.8644	0.7640	0.6161	0.4001	0.2317	0.2595	0.5542	0.8057	0.9111	0.9470	(94)
Useful gains	1076.0931	1220.8923	1355.2921	1422.1007	1234.4649	829.7657	455.7783	473.8473	892.7878	1070.7179	1046.2149	1015.3998	(95)
Ext temp	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	2966.7542	2899.2788	2602.7151	2151.6715	1541.9577	894.6450	465.3653	486.7924	1055.2568	1753.6317	2399.3525	2931.8583	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	1406.6519	1127.8758	928.0827	525.2910	228.7746	0.0000	0.0000	0.0000	0.0000	508.0879	974.2591	1425.8452 (98)
Space heating												7124.8681 (98)
RHI space heating demand												7125 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	243.9994	243.3047	242.6238	239.4257	238.8274	236.0419	236.0419	235.5261	237.1148	238.8274	240.0378	241.3033 (39)
Average = Sum(39)m / 12 =												239.4228 (39)
HLP	1.2783	1.2746	1.2711	1.2543	1.2512	1.2366	1.2366	1.2339	1.2422	1.2512	1.2575	1.2642 (40)
HLP (average)												1.2543 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					1.8900	10.6334	0.6300	0.7000			0.7700			6.1419 (74)
East					21.3700	19.6403	0.6300	0.7000			0.7700			128.2696 (76)
South					2.4900	46.7521	0.6300	0.7000			0.7700			35.5772 (78)
West					11.4300	19.6403	0.6300	0.7000			0.7700			68.6065 (80)

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)		
Total gains	1113.6096	1324.2114	1564.7841	1826.0343	1995.5962	1975.0142	1887.4383	1730.6933	1536.8832	1283.0278	1101.7271	1048.7656 (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	21.7305	21.7925	21.8537	22.1456	22.2011	22.4631	22.4631	22.5123	22.3614	22.2011	22.0891	21.9733
alpha	2.4487	2.4528	2.4569	2.4764	2.4801	2.4975	2.4975	2.5008	2.4908	2.4801	2.4726	2.4649
util living area	0.9693	0.9526	0.9192	0.8525	0.7497	0.6135	0.4867	0.5360	0.7355	0.8956	0.9558	0.9733 (86)
MIT	18.8775	19.1037	19.4899	19.9837	20.4003	20.6890	20.8110	20.7866	20.5484	19.9868	19.3463	18.8432 (87)
Th 2	19.8579	19.8607	19.8636	19.8768	19.8793	19.8908	19.8908	19.8930	19.8864	19.8793	19.8742	19.8690 (88)
util rest of house	0.9644	0.9451	0.9060	0.8275	0.7050	0.5397	0.3839	0.4334	0.6720	0.8724	0.9475	0.9690 (89)
MIT 2	17.0181	17.3468	17.9036	18.6099	19.1782	19.5511	19.6817	19.6636	19.3909	18.6316	17.7110	16.9755 (90)
Living area fraction	17.2726	17.5873	18.1207	18.7980	19.3455	19.7069	19.8363	19.8173	19.5494	18.8171	17.9349	17.2312 (92)
MIT	17.2726	17.5873	18.1207	18.7980	19.3455	19.7069	19.8363	19.8173	19.5494	18.8171	17.9349	17.2312 (93)
Temperature adjustment												0.0000
adjusted MIT	17.2726	17.5873	18.1207	18.7980	19.3455	19.7069	19.8363	19.8173	19.5494	18.8171	17.9349	17.2312 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1056.1325	1223.9667	1376.2671	1457.3289	1357.7127	1038.9663	714.3189	736.7352	998.0283	1082.5081	1021.7421	1001.0331 (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	3165.3166	3086.8760	2819.4672	2369.8288	1825.9604	1205.4358	763.9098	804.8694	1292.1269	1962.4726	2600.7755	3144.4717 (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	1569.2329	1251.8750	1073.7409	656.9999	348.3763	0.0000	0.0000	0.0000	0.0000	654.6936	1136.9041	1594.7183 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 8286.5411 (98)
43.4123 (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) 0.1000 (201)
Fraction of space heat from main system(s) 0.9000 (202)
Efficiency of main space heating system 1 (in %) 224.4000 (206)
Efficiency of secondary/supplementary heating system, % 65.0000 (208)
Space heating requirement 3323.4790 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1569.2329	1251.8750	1073.7409	656.9999	348.3763	0.0000	0.0000	0.0000	0.0000	654.6936	1136.9041	1594.7183	(98)
Space heating efficiency (main heating system 1)	224.4000	224.4000	224.4000	224.4000	224.4000	0.0000	0.0000	0.0000	0.0000	224.4000	224.4000	224.4000	(210)
Space heating fuel (main heating system)	629.3715	502.0889	430.6447	263.5026	139.7231	0.0000	0.0000	0.0000	0.0000	262.5776	455.9776	639.5929	(211)
Water heating requirement	241.4205	192.5962	165.1909	101.0769	53.5964	0.0000	0.0000	0.0000	0.0000	100.7221	174.9083	245.3413	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	(216)
Fuel for water heating, kWh/month	100.2260	88.3377	92.7699	83.1563	81.4862	72.8049	69.9157	76.7270	76.5940	86.2285	91.1852	97.8126	(219)
Water heating fuel used												1017.2440	(219)
Annual totals kWh/year													
Space heating fuel - main system													3323.4790 (211)
Space heating fuel - secondary													1274.8525 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													30.0000 (231)
Electricity for lighting (calculated in Appendix L)													576.1345 (232)
Total delivered energy for all uses													6221.7100 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3323.4790	13.1900	438.3669	(240)
Space heating - secondary	1274.8525	4.2300	53.9263	(242)
Water heating (other fuel)	1017.2440	13.1900	134.1745	(247)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Energy for lighting	576.1345	13.1900	75.9921	(250)
Additional standing charges			0.0000	(251)
Total energy cost			706.4168	(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] = 1.2578 (257)
SAP value 82.4534
SAP rating (Section 12) 82 (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	3323.4790	0.5190	1724.8856	(261)
Space heating - secondary	1274.8525	0.0190	24.2222	(263)
Water heating (other fuel)	1017.2440	0.5190	527.9496	(264)
Space and water heating			2277.0575	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Total kg/year			2591.6413	(272)
CO2 emissions per m2			13.5800	(273)
EI value			85.2773	
EI rating			85	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency 13.19 x (1 + 0.29 x 0.25) / 2.2440 = 6.304, stars = 3
Main heating environmental impact 0.519 x (1 + 0.29 x 0.25) / 2.2440 = 0.2481, stars = 4
Water heating energy efficiency 13.19 / 2.2440 = 5.878, stars = 3

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.519 / 2.2440 = 0.2313$, stars = 4

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

100.0000 (35)
35.4385 (36)
(33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	238.2428	237.1148	237.1148	235.5261	235.5261	233.6003	234.0611	233.1533	233.6003	234.5357	234.5357	236.0419 (39)
Average = Sum(39)m / 12 =												235.2544 (39)
HLP	1.2481	1.2422	1.2422	1.2339	1.2339	1.2238	1.2262	1.2215	1.2238	1.2287	1.2287	1.2366 (40)
HLP (average)												1.2325 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum (64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North					1.8900	11.9814	0.6300		0.7000		0.7700		6.9206 (74)
East					21.3700	22.3313	0.6300		0.7000		0.7700		145.8447 (76)
South					2.4900	50.9848	0.6300		0.7000		0.7700		38.7982 (78)
West					11.4300	22.3313	0.6300		0.7000		0.7700		78.0068 (80)

Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284	(83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305	(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	22.2555	22.3614	22.3614	22.5123	22.6978	22.6531	22.7414	22.6978	22.6073	22.6073	22.6073	22.4631
alpha	2.4837	2.4908	2.4908	2.5008	2.5008	2.5132	2.5102	2.5161	2.5132	2.5072	2.5072	2.4975
util living area	0.9637	0.9469	0.9073	0.8229	0.6921	0.4962	0.3492	0.3820	0.6512	0.8656	0.9443	0.9683 (86)
MIT	19.0694	19.2665	19.6665	20.1544	20.5535	20.7982	20.8669	20.8603	20.6840	20.1727	19.5506	19.0426 (87)
Th 2	19.8817	19.8864	19.8864	19.8930	19.8930	19.9010	19.8991	19.9029	19.9010	19.8971	19.8971	19.8908 (88)
util rest of house	0.9578	0.9383	0.8916	0.7924	0.6360	0.4064	0.2329	0.2612	0.5697	0.8348	0.9335	0.9631 (89)
MIT 2	17.3121	17.5991	18.1720	18.8582	19.3872	19.6762	19.7336	19.7336	19.5640	18.9033	18.0208	17.2796 (90)
Living area fraction	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209 (92)
MIT	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209 (93)
Temperature adjustment												0.0000
adjusted MIT	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1076.0931	1220.8923	1355.2921	1422.1007	1234.4649	829.7657	455.7783	473.8473	892.7878	1070.7179	1046.2149	1015.3998 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	2966.7542	2899.2788	2602.7151	2151.6715	1541.9577	894.6450	465.3653	486.7924	1055.2568	1753.6317	2399.3525	2931.8583 (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	1406.6519	1127.8758	928.0827	525.2910	228.7746	0.0000	0.0000	0.0000	0.0000	508.0879	974.2591	1425.8452 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating 7124.8681 (98)
Space heating per m2 (98) / (4) = 37.3264 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													224.4000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													2857.5674 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1406.6519	1127.8758	928.0827	525.2910	228.7746	0.0000	0.0000	0.0000	0.0000	508.0879	974.2591	1425.8452	(98)
Space heating efficiency (main heating system 1)	224.4000	224.4000	224.4000	224.4000	224.4000	0.0000	0.0000	0.0000	0.0000	224.4000	224.4000	224.4000	(210)
Space heating fuel (main heating system)	564.1652	452.3566	372.2257	210.6782	91.7545	0.0000	0.0000	0.0000	0.0000	203.7786	390.7456	571.8630	(211)
Water heating requirement	216.4080	173.5193	142.7820	80.8140	35.1961	0.0000	0.0000	0.0000	0.0000	78.1674	149.8860	219.3608	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	(216)
(217)m	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	(217)
Fuel for water heating, kWh/month	100.2260	88.3377	92.7699	83.1563	81.4862	72.8049	69.9157	76.7270	76.5940	86.2285	91.1852	97.8126	(219)
Water heating fuel used												1017.2440	(219)
Annual totals kWh/year													
Space heating fuel - main system												2857.5674	(211)
Space heating fuel - secondary												1096.1335	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Total delivered energy for all uses												5577.0794	(238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2857.5674	17.5600	501.7888 (240)
Space heating - secondary	1096.1335	4.6500	50.9702 (242)
Water heating (other fuel)	1017.2440	17.5600	178.6281 (247)
Pumps and fans for heating	30.0000	17.5600	5.2680 (249)
Energy for lighting	576.1345	17.5600	101.1692 (250)
Additional standing charges			0.0000 (251)
Total energy cost			837.8243 (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	2857.5674	0.5190	1483.0775 (261)
Space heating - secondary	1096.1335	0.0190	20.8265 (263)
Water heating (other fuel)	1017.2440	0.5190	527.9496 (264)
Space and water heating			2031.8537 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total kg/year			2346.4375 (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	2857.5674	3.0700	8772.7319 (261)
Space heating - secondary	1096.1335	1.0400	1139.9789 (263)
Water heating (other fuel)	1017.2440	3.0700	3122.9391 (264)
Space and water heating			13035.6500 (265)
Pumps and fans	30.0000	3.0700	92.1000 (267)
Energy for lighting	576.1345	3.0700	1768.7328 (268)
Primary energy kWh/year			14896.4828 (272)
Primary energy kWh/m2/year			78.0411 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 82
Current environmental impact rating: B 85

(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		Recommended
L2			Not considered
Q3			Not considered
O3			Not considered
Recommended measures:			
N	Solar water heating	SAP change + 1.2	Cost change -£ 67
U	Solar photovoltaic panels	+ 5.7	-£ 320
V2	Wind turbine	+ 11.7	-£ 628
		CO2 change	
			-198 kg (8.4%)
			-947 kg (44.1%)
			-1856 kg (154.5%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£67	1.04 kg/m²	B 84 B 86
Solar photovoltaic panels	£320	4.96 kg/m²	B 89 B 91
Wind turbine	£628	9.72 kg/m²	A 101 A 102
Total Savings	£1015	15.72 kg/m²	

Potential energy efficiency rating: A 101
Potential environmental impact rating: A 102

Fuel prices for cost data on this page from database revision number 445 TEST (30 Jul 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£787	£720	£67
Wood	£51	£51	-£0
Space heating	£558	£558	-£0
Water heating	£179	£111	£67
Lighting	£101	£101	£0
Generated (PV)	-£0	-£320	£320
Generated (wind)	-£0	-£628	£628
Total cost of fuels	£838	-£177	£1015
Total cost of uses	£838	-£178	£1015
Delivered energy	29 kWh/m²	-1 kWh/m²	30 kWh/m²
Carbon dioxide emissions	2.3 tonnes	-0.7 tonnes	3.0 tonnes
CO2 emissions per m²	12 kg/m²	-3 kg/m²	16 kg/m²
Primary energy	78 kWh/m²	-15 kWh/m²	93 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																6 * 10 =	60.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000 / (5) =	0.1297 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3797 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3797 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Adj infilt rate	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)					
	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)					
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)					

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	243.9994	243.3047	242.6238	239.4257	238.8274	236.0419	236.0419	235.5261	237.1148	238.8274	240.0378	241.3033 (39)
Average = Sum(39)m / 12 =												239.4228 (39)
HLP	Jan 1.2783	Feb 1.2746	Mar 1.2711	Apr 1.2543	May 1.2512	Jun 1.2366	Jul 1.2366	Aug 1.2339	Sep 1.2422	Oct 1.2512	Nov 1.2575	Dec 1.2642 (40)
HLP (average)												1.2543 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	Jan 115.7349	Feb 111.5263	Mar 107.3178	Apr 103.1092	May 98.9007	Jun 94.6922	Jul 94.6922	Aug 98.9007	Sep 103.1092	Oct 107.3178	Nov 111.5263	Dec 115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	206.7799	179.8491	170.0608	150.7676	143.8638	160.0790	166.4741	192.1011	204.6195	219.4915 (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												1.0956 (H8)
Utilisation factor												0.5986 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												0.7128 (H15)
Solar storage volume factor												0.9323 (H16)
Solar input												-889.9440 (H17)
Solar input	-25.8066	-43.0638	-73.3426	-98.2935	-121.4334	-119.3883	-117.8106	-102.9317	-80.6162	-55.0513	-30.6103	-21.5957 (63)
Solar input (sum of months) = Sum(63)m =												-889.9440 (63)
Output from w/h	199.1005	155.1661	133.4373	81.5555	48.6274	31.3792	26.0532	57.1473	85.8579	137.0498	174.0091	197.8958 (64)
Total per year (kWh/year) = Sum(64)m =												1327.2792 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	93.0082	80.7454	75.4702	68.3395	66.6510	72.4775	76.9297	88.1275	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	125.0110	112.1464	101.4385	94.9160	89.5846	97.4160	106.8468	118.4509	127.9707	131.5689	(72)
Total internal gains	875.0143	869.0762	834.8608	777.5824	717.6149	670.1863	643.2630	654.6022	691.7005	747.7184	806.4977	851.0021	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W
North					1.8900	10.6334	0.6300	0.7000				0.7700			6.1419 (74)
East					21.3700	19.6403	0.6300	0.7000				0.7700			128.2696 (76)
South					2.4900	46.7521	0.6300	0.7000				0.7700			35.5772 (78)
West					11.4300	19.6403	0.6300	0.7000				0.7700			68.6065 (80)
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294				197.7635 (83)
Total gains	1113.6096	1324.2114	1563.2833	1818.5303	1981.8389	1961.0067	1873.4308	1717.6864	1530.8800	1281.5270	1101.7271				1048.7656 (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	21.7305	21.7925	21.8537	22.1456	22.2011	22.4631	22.4631	22.5123	22.3614	22.2011	22.0891	21.9733
alpha	2.4487	2.4528	2.4569	2.4764	2.4801	2.4975	2.4975	2.5008	2.4908	2.4801	2.4726	2.4649
util living area	0.9693	0.9526	0.9194	0.8535	0.7520	0.6163	0.4895	0.5389	0.7368	0.8958	0.9558	0.9733 (86)
MIT	18.8775	19.1037	19.4892	19.9806	20.3964	20.6869	20.8100	20.7853	20.5468	19.9861	19.3463	18.8432 (87)
Th 2	19.8579	19.8607	19.8636	19.8768	19.8793	19.8908	19.8908	19.8930	19.8864	19.8793	19.8742	19.8690 (88)
util rest of house	0.9644	0.9451	0.9062	0.8286	0.7075	0.5424	0.3864	0.4361	0.6735	0.8727	0.9475	0.9690 (89)
MIT 2	17.0181	17.3468	17.9025	18.6057	19.1735	19.5489	19.6810	19.6626	19.3891	18.6306	17.7110	16.9755 (90)
Living area fraction									fLA = Living area / (4) =			0.1369 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT	17.2726	17.5873	18.1197	18.7940	19.3409	19.7047	19.8355	19.8163	19.5476	18.8162	17.9349	17.2312 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2726	17.5873	18.1197	18.7940	19.3409	19.7047	19.8355	19.8163	19.5476	18.8162	17.9349	17.2312 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9484	0.9243	0.8797	0.7992	0.6827	0.5286	0.3808	0.4282	0.6507	0.8440	0.9274	0.9545 (94)	
Useful gains	1056.1325	1223.9667	1375.2301	1453.3480	1352.9782	1036.6380	713.4323	735.5682	996.2193	1081.5841	1021.7421	1001.0331 (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	3165.3166	3086.8760	2819.2136	2368.8675	1824.8563	1204.9242	763.7190	804.6164	1291.7089	1962.2482	2600.7755	3144.4717 (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	1569.2329	1251.8750	1074.3237	659.1741	351.0774	0.0000	0.0000	0.0000	0.0000	655.2141	1136.9041	1594.7183 (98)	
Space heating												8292.5196 (98)	
Space heating per m2												(98) / (4) = 43.4436 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													224.4000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													3325.8768 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1569.2329	1251.8750	1074.3237	659.1741	351.0774	0.0000	0.0000	0.0000	0.0000	655.2141	1136.9041	1594.7183 (98)	
Space heating efficiency (main heating system 1)	224.4000	224.4000	224.4000	224.4000	224.4000	0.0000	0.0000	0.0000	0.0000	224.4000	224.4000	224.4000 (210)	
Space heating fuel (main heating system)	629.3715	502.0889	430.8785	264.3746	140.8064	0.0000	0.0000	0.0000	0.0000	262.7864	455.9776	639.5929 (211)	
Water heating requirement	241.4205	192.5962	165.2806	101.4114	54.0119	0.0000	0.0000	0.0000	0.0000	100.8022	174.9083	245.3413 (215)	
Water heating													
Water heating requirement	199.1005	155.1661	133.4373	81.5555	48.6274	31.3792	26.0532	57.1473	85.8579	137.0498	174.0091	197.8958 (64)	
Efficiency of water heater (217)m	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000 (216)	
Fuel for water heating, kWh/month	88.7257	69.1471	59.4640	36.3438	21.6700	13.9836	11.6102	25.4667	38.2611	61.0739	77.5442	88.1889 (219)	
Water heating fuel used												591.4791 (219)	
Annual totals kWh/year													
Space heating fuel - main system													3325.8768 (211)
Space heating fuel - secondary													1275.7722 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													80.0000 (231)
Electricity for lighting (calculated in Appendix L)													576.1345 (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)
Wind generation													-3575.5408 (234)
Total delivered energy for all uses													546.4825 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3325.8768	13.1900	438.6832 (240)	
Space heating - secondary	1275.7722	4.2300	53.9652 (242)	
Water heating (other fuel)	591.4791	13.1900	78.0161 (247)	
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)	
Pump for solar water heating	50.0000	13.1900	6.5950 (249)	
Energy for lighting	576.1345	13.1900	75.9921 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229 (252)	
Wind Turbine	-3575.5408	13.1900	-471.6138 (252)	
Total energy cost			-42.2281 (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] =	-0.0752 (257)
SAP value		101.0489
SAP rating (Section 12)		101 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP band

A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3325.8768	0.5190	1726.1301 (261)
Space heating - secondary	1275.7722	0.0190	24.2397 (263)
Water heating (other fuel)	591.4791	0.5190	306.9777 (264)
Space and water heating			2057.3474 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-354.2617 (272)
CO2 emissions per m2			-1.8600 (273)
EI value			102.0125
EI rating			102 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
Effective ac	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

100.0000 (35)
35.4385 (36)
(33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	238.2428	237.1148	237.1148	235.5261	235.5261	233.6003	234.0611	233.1533	233.6003	234.5357	234.5357	236.0419 (39)
Average = Sum(39)m / 12 =												235.2544 (39)
HLP	1.2481	1.2422	1.2422	1.2339	1.2339	1.2238	1.2262	1.2215	1.2238	1.2287	1.2287	1.2366 (40)
HLP (average)												1.2325 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss												
30.0132 27.1087 30.0132 29.0450 30.0132 29.0450 30.0132 30.0132 29.0450 30.0132 29.0450 30.0132 29.0450 30.0132 (56)												
If cylinder contains dedicated solar storage												
30.0132 27.1087 30.0132 29.0450 30.0132 29.0450 30.0132 30.0132 29.0450 30.0132 29.0450 30.0132 29.0450 30.0132 (57)												
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	206.7799	179.8491	170.0608	150.7676	143.8638	160.0790	166.4741	192.1011	204.6195	219.4915 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1570 (H8)
Utilisation factor												0.5786 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												0.7128 (H15)
Solar storage volume factor												0.9323 (H16)
Solar input												-908.5616 (H17)
Solar input	-27.9651	-42.0314	-70.7863	-97.8483	-117.8423	-124.0239	-121.0458	-108.0946	-84.3682	-57.3941	-33.9923	-23.1692 (63)
Solar input (sum of months) = Sum(63)m =												-908.5616 (63)
Output from w/h	196.9420	156.1984	135.9936	82.0007	52.2185	26.7437	22.8180	51.9844	82.1058	134.7070	170.6272	196.3223 (64)
Total per year (kWh/year) = Sum(64)m =												1308.6616 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	93.0082	80.7454	75.4702	68.3395	66.6510	72.4775	76.9297	88.1275	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	125.0110	112.1464	101.4385	94.9160	89.5846	97.4160	106.8468	118.4509	127.9707	131.5689	(72)
Total internal gains	875.0143	869.0762	834.8608	777.5824	717.6149	670.1863	643.2630	654.6022	691.7005	747.7184	806.4977	851.0021	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					1.8900	11.9814	0.6300	0.7000			0.7700			6.9206 (74)
East					21.3700	22.3313	0.6300	0.7000			0.7700			145.8447 (76)
South					2.4900	50.9848	0.6300	0.7000			0.7700			38.7982 (78)
West					11.4300	22.3313	0.6300	0.7000			0.7700			78.0068 (80)

Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284 (83)		
Total gains	1144.5846	1332.0067	1566.4819	1853.7717	1989.7903	2059.8031	1953.4457	1813.2508	1604.9328	1327.4305	1148.2845	1072.2305 (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	22.2555	22.3614	22.3614	22.5123	22.5123	22.6978	22.6531	22.7414	22.6978	22.6073	22.6073	22.4631
alpha	2.4837	2.4908	2.4908	2.5008	2.5008	2.5132	2.5102	2.5161	2.5132	2.5072	2.5072	2.4975
util living area	0.9637	0.9469	0.9074	0.8241	0.6946	0.4987	0.3514	0.3843	0.6526	0.8658	0.9443	0.9683 (86)
MIT	19.0694	19.2665	19.6658	20.1516	20.5504	20.7971	20.8665	20.8598	20.6829	20.1720	19.5506	19.0426 (87)
Th 2	19.8817	19.8864	19.8864	19.8930	19.8930	19.9010	19.8991	19.9029	19.9010	19.8971	19.8971	19.8908 (88)
util rest of house	0.9578	0.9383	0.8918	0.7936	0.6387	0.4087	0.2345	0.2630	0.5712	0.8351	0.9335	0.9631 (89)
MIT 2	17.3121	17.5991	18.1710	18.8545	19.3837	19.6753	19.7328	19.7334	19.5630	18.9024	18.0208	17.2796 (90)
Living area fraction									fLA = Living area /	(4) =		0.1369 (91)

MIT	17.5527	17.8273	18.3756	19.0321	19.5434	19.8289	19.8880	19.8876	19.7163	19.0762	18.2302	17.5209 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5527	17.8273	18.3756	19.0321	19.5434	19.8289	19.8880	19.8876	19.7163	19.0762	18.2302	17.5209 (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

Water heating (other fuel)	583.1825	0.5190	302.6717 (264)
Space and water heating			1807.6333 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-654.2774 (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	2859.5768	3.0700	8778.9009 (261)
Space heating - secondary	1096.9043	1.0400	1140.7805 (263)
Water heating (other fuel)	583.1825	3.0700	1790.3704 (264)
Space and water heating			11710.0518 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	576.1345	3.0700	1768.7328 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Wind Turbine	-3575.5408	3.0700	-10976.9101 (269)
Primary energy kWh/year			-2852.6956 (272)
Primary energy kWh/m2/year			-14.9450 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0669 V2			Issued on Date	16/07/2019
Assessment Reference	Rev J	Prop Type Ref			
Property					
SAP Rating	89 B	DER	8.67	TER	23.59
Environmental	92 A	% DER<TER	63.25		
CO ₂ Emissions (t/year)	1.18	DFEE	51.77	TFEE	61.71
General Requirements Compliance	Pass	% DFEE<TFEE	16.12		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com			Assessor ID	E477-0001
Client	HJ Concepts, HJC				

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

Detached House, total floor area 191 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:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 23.59 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 8.67 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)51.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (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: Heat pump with radiators or underfloor - Electric
Ground-to-water heat pump

Secondary heating system: Room heaters - Wood Logs

Closed room heater

Efficiency: 65%

Minimum: 65% OK

5 Cylinder insulation

Hot water storage Nominal cylinder loss: 1.79 kWh/day

Permitted by DBSCG 2.30 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North: 1.89 m², No overhang
Windows facing East: 21.37 m², No overhang
Windows facing South: 2.49 m², No overhang
Windows facing West: 11.43 m², Overhang twice as wide as window, ratio 1.88
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Window U-value 1.10 W/m²K
Secondary heating (wood logs)
Secondary heating fuel: wood logs
Photovoltaic array 2.50 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																6 * 10 =	60.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					60.0000 / (5) =	0.1297 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.3797 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3797 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Adj infilt rate	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)					
	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)					
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)					

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	243.9994	243.3047	242.6238	239.4257	238.8274	236.0419	236.0419	235.5261	237.1148	238.8274	240.0378	241.3033 (39)
Average = Sum(39)m / 12 =												239.4228 (39)
HLP	Jan 1.2783	Feb 1.2746	Mar 1.2711	Apr 1.2543	May 1.2512	Jun 1.2366	Jul 1.2366	Aug 1.2339	Sep 1.2422	Oct 1.2512	Nov 1.2575	Dec 1.2642 (40)
HLP (average)												1.2543 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	Jan 115.7349	Feb 111.5263	Mar 107.3178	Apr 103.1092	May 98.9007	Jun 94.6922	Jul 94.6922	Aug 98.9007	Sep 103.1092	Oct 107.3178	Nov 111.5263	Dec 115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	599.7562	597.4377	577.5059	544.7514	510.3333	478.0559	457.6459	464.3649	481.6767	514.6716	552.6540	582.2573 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.8900	10.6334	0.6300	0.7000	0.7700		6.1419 (74)	
East					21.3700	19.6403	0.6300	0.7000	0.7700		128.2696 (76)	
South					2.4900	46.7521	0.6300	0.7000	0.7700		35.5772 (78)	
West					11.4300	19.6403	0.6300	0.7000	0.7700		68.6065 (80)	
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	838.3514	1052.5730	1305.9284	1585.6993	1774.5573	1768.8763	1687.8137	1527.4491	1320.8562	1048.4801	847.8834	780.0208 (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	21.7305	21.7925	21.8537	22.1456	22.2011	22.4631	22.4631	22.5123	22.3614	22.2011	22.0891	21.9733
alpha	2.4487	2.4528	2.4569	2.4764	2.4801	2.4975	2.4975	2.5008	2.4908	2.4801	2.4726	2.4649
util living area	0.9834	0.9706	0.9431	0.8840	0.7874	0.6558	0.5292	0.5844	0.7852	0.9284	0.9746	0.9861 (86)
MIT	18.7061	18.9424	19.3506	19.8788	20.3334	20.6538	20.7937	20.7628	20.4850	19.8677	19.1929	18.6733 (87)
Th 2	19.8579	19.8607	19.8636	19.8768	19.8793	19.8908	19.8908	19.8930	19.8864	19.8793	19.8742	19.8690 (88)
util rest of house	0.9806	0.9656	0.9332	0.8628	0.7460	0.5824	0.4219	0.4789	0.7270	0.9111	0.9695	0.9837 (89)
MIT 2	16.7702	17.1151	17.7071	18.4682	19.0957	19.5156	19.6692	19.6450	19.3186	18.4687	17.4911	16.7293 (90)
Living area fraction	17.0352	17.3652	17.9321	18.6613	19.2651	19.6714	19.8232	19.7980	19.4782	18.6602	17.7240	16.9954 (92)
MIT	17.0352	17.3652	17.9321	18.6613	19.2651	19.6714	19.8232	19.7980	19.4782	18.6602	17.7240	16.9954 (93)
Temperature adjustment												0.0000
adjusted MIT	17.0352	17.3652	17.9321	18.6613	19.2651	19.6714	19.8232	19.7980	19.4782	18.6602	17.7240	16.9954 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9701	0.9500	0.9102	0.8338	0.7190	0.5660	0.4147	0.4687	0.7009	0.8852	0.9552	0.9746 (94)
Ext temp.	813.3246	999.9472	1188.6700	1322.1777	1275.9578	1001.1287	699.9344	715.8561	925.7762	928.1590	809.8726	760.2260 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	3107.3729	3032.8509	2773.6967	2337.0963	1806.7594	1197.0567	760.7990	800.3130	1275.2627	1924.9877	2550.1734	3087.5812 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
	1706.7719	1366.1113	1179.2599	730.7414	394.9164	0.0000	0.0000	0.0000	0.0000	741.6406	1253.0166	1731.5522 (98)

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (Uw = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

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Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (56)												
If cylinder contains dedicated solar storage												
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 28.4842 27.5653 28.4842 27.5653 28.4842 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
223.3780 196.8488 206.6466 185.1230 181.3261 161.8946 155.3617 170.6464 170.3972 191.9678 203.1398 217.9625 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625 (64)
Total per year (kWh/year) = Sum(64)m =												2264.6926 (64)
Heat gains from water heating, kWh/month												
98.4647 87.3026 92.9015 84.9645 84.4824 77.2411 75.8493 80.9315 80.0682 88.0208 90.9551 96.6641 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
32.6231 28.9756 23.5645 17.8399 13.3355 11.2584 12.1651 15.8126 21.2237 26.9484 31.4527 33.5298 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
362.2933 366.0527 356.5790 336.4105 310.9514 287.0235 271.0381 267.2787 276.7524 296.9209 322.3800 346.3079 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 37.9502 (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)												
-119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 -119.6017 (71)												
Water heating gains (Table 5)												
132.3451 129.9147 124.8677 118.0063 113.5517 107.2793 101.9480 108.7789 111.2059 118.3076 126.3266 129.9248 (72)												
Total internal gains	598.1121	595.7936	575.8618	543.1073	508.6892	476.4118	456.0018	462.7208	480.0326	513.0274	551.0099	580.6132 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	1.8900	10.6334	0.6300	0.7000	0.7700	6.1419 (74)
East	21.3700	19.6403	0.6300	0.7000	0.7700	128.2696 (76)
South	2.4900	46.7521	0.6300	0.7000	0.7700	35.5772 (78)
West	11.4300	19.6403	0.6300	0.7000	0.7700	68.6065 (80)

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	836.7073	1050.9289	1304.2843	1584.0552	1772.9132	1767.2322	1686.1696	1525.8050	1319.2121	1046.8360	846.2392	778.3767 (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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000
util living area	0.9995	0.9984	0.9936	0.9710	0.8970	0.7427	0.5757	0.6486	0.8949	0.9897	0.9988	0.9997 (86)
MIT	19.5049	19.6800	19.9848	20.3878	20.7301	20.9271	20.9832	20.9711	20.8044	20.3367	19.8455	19.4795 (87)
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054 (88)
util rest of house												
0.9993 0.9978 0.9911 0.9591 0.8547 0.6489 0.4450 0.5155 0.8338 0.9838 0.9983 0.9995 (89)												
MIT 2	17.8906	18.1483	18.5943	19.1807	19.6434	19.8733	19.9165	19.9121	19.7520	19.1164	18.3982	17.8595 (90)
Living area fraction												
MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (91)
Temperature adjustment												0.0000
adjusted MIT	18.1116	18.3580	18.7846	19.3460	19.7922	20.0175	20.0625	20.0571	19.8960	19.2834	18.5963	18.0813 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9988 0.9965 0.9873 0.9507 0.8490 0.6580 0.4627 0.5331 0.8322 0.9787 0.9973 0.9992 (94)												
Useful gains	835.7296	1047.2189	1287.7359	1505.9743	1505.2837	1162.8179	780.2572	813.4162	1097.8307	1024.5788	843.9235	777.7367 (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												
3241.1589 3150.8497 2869.5702 2413.8371 1866.1266 1237.4841 790.9136 833.8799 1328.8209 2002.4784 2662.0772 3228.1329 (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	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948 (98)
Space heating												9162.0152 (98)
Space heating per m2												(98) / (4) = 47.9988 (99)

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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 %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													9798.9467	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1789.6394	1413.6399	1176.8847	653.6613	268.4671	0.0000	0.0000	0.0000	0.0000	727.5573	1309.0707	1823.0948	(98)	
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)	
Space heating fuel (main heating system)	1914.0529	1511.9144	1258.7002	699.1029	287.1306	0.0000	0.0000	0.0000	0.0000	778.1361	1400.0756	1949.8340	(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	223.3780	196.8488	206.6466	185.1230	181.3261	161.8946	155.3617	170.6464	170.3972	191.9678	203.1398	217.9625	(64)	
Efficiency of water heater (217)m	89.1732	89.0407	88.7231	87.8988	85.8590	79.8000	79.8000	79.8000	79.8000	88.0356	88.8987	89.2224	(216)	
Fuel for water heating, kWh/month	250.4991	221.0774	232.9118	210.6092	211.1906	202.8754	194.6888	213.8427	213.5304	218.0569	228.5069	244.2911	(219)	
Water heating fuel used												2642.0803	(219)	
Annual totals kWh/year														
Space heating fuel - main system													9798.9467	(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)													576.1345	(232)
Total delivered energy for all uses													13092.1615	(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	9798.9467	0.2160	2116.5725 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2642.0803	0.2160	570.6893 (264)
Space and water heating			2687.2618 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Total CO2, kg/m2/year			3025.2006 (272)
Emissions per m2 for space and water heating			14.0783 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.5665 (272b)
Emissions per m2 for pumps and fans			0.2039 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0783 * 1.55) + 1.5665 + 0.2039, rounded to 2 d.p.			23.5900 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	240.1573	239.6118	239.0772	236.5660	236.0961	233.9089	233.9089	233.5039	234.7514	236.0961	237.0466	238.0403 (39)
Average = Sum(39)m / 12 =												236.5637 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2582	1.2553	1.2525	1.2393	1.2369	1.2254	1.2254	1.2233	1.2298	1.2369	1.2419	1.2471 (40)
HLP (average)												1.2393 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North				1.8900	10.6334		0.6300	0.7000	0.7700	6.1419 (74)		
East				21.3700	19.6403		0.6300	0.7000	0.7700	128.2696 (76)		
South				2.4900	46.7521		0.6300	0.7000	0.7700	35.5772 (78)		
West				11.4300	19.6403		0.6300	0.7000	0.7700	68.6065 (80)		
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262 (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	22.0781	22.1284	22.1779	22.4133	22.4579	22.6679	22.6679	22.7072	22.5865	22.4579	22.3678	22.2745	
alpha	2.4719	2.4752	2.4785	2.4942	2.4972	2.5112	2.5112	2.5138	2.5058	2.4972	2.4912	2.4850	
util living area	0.9871	0.9755	0.9499	0.8936	0.7996	0.6707	0.5444	0.6027	0.8025	0.9387	0.9798	0.9894	(86)
MIT	18.0500	18.3669	18.9147	19.6205	20.2353	20.6683	20.8611	20.8161	20.4314	19.5925	18.6885	17.9996	(87)
Th 2	19.8738	19.8760	19.8782	19.8887	19.8906	19.8997	19.8997	19.9014	19.8962	19.8906	19.8867	19.8825	(88)
util rest of house	0.9849	0.9713	0.9411	0.8739	0.7597	0.5982	0.4366	0.4972	0.7470	0.9235	0.9758	0.9876	(89)
MIT 2	17.1663	17.4825	18.0256	18.7209	19.3025	19.6910	19.8372	19.8122	19.5009	18.7078	17.8118	17.1218	(90)
Living area fraction	17.2872	17.6035	18.1473	18.8441	19.4302	19.8248	19.9774	19.9496	19.6283	18.8289	17.9318	17.2420	(91)
MIT	17.2872	17.6035	18.1473	18.8441	19.4302	19.8248	19.9774	19.9496	19.6283	18.8289	17.9318	17.2420	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.2872	17.6035	18.1473	18.8441	19.4302	19.8248	19.9774	19.9496	19.6283	18.8289	17.9318	17.2420	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9774	0.9594	0.9229	0.8507	0.7403	0.5926	0.4449	0.5023	0.7307	0.9039	0.9654	0.9812	(94)
Ext temp.	733.4228	926.3270	1126.5351	1278.4877	1253.5446	1001.5147	716.7227	727.3822	906.4350	872.7905	735.7117	679.8987	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3118.9805	3043.9152	2784.6153	2352.4313	1825.0638	1222.1344	789.9961	828.8548	1297.7700	1942.8190	2567.6388	3104.5199	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1774.8549	1423.0193	1233.6116	773.2393	425.2102	0.0000	0.0000	0.0000	0.0000	796.1012	1318.9875	1803.9181	(98)
Space heating per m2												9548.9422	(98)
												50.0259	(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	2198.7438	1730.9259	1774.6294	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7010	0.7677	0.7264	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1541.3432	1328.8635	1289.1774	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	412.3296	512.8152	402.9018	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1328.0465 (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	103.0824	128.2038	100.7255	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												332.0116 (107)
Space cooling per m2												1.7394 (108)
Energy for space heating												50.0259 (99)
Energy for space cooling												1.7394 (108)
Total												51.7653 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0865 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3365 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4290	0.4206	0.4122	0.3701	0.3617	0.3197	0.3197	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5885	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			4.2400	1.2000	5.0880		(26a)
TER Opening Type (U _w = 1.40)			37.1800	1.3258	49.2917		(27)
Ground Floor			102.0800	0.1300	13.2704		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.1800	20.0250		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.1800	8.3862		(29a)
Dormers	12.0300	5.6300	6.4000	0.1800	1.1520		(29a)
Stud to Loft Void	17.9800		17.9800	0.1800	3.2364		(29a)
Pitched Roof	74.0600		74.0600	0.1300	9.6278		(30)
Sloping Ceilings	35.6300		35.6300	0.1300	4.6319		(30)
Flat Roof	7.1700		7.1700	0.1300	0.9321		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.1300	1.5379		(30)
Total net area of external elements A _{um} (A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.1794		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
27.1229 (36)
(33) + (36) = 144.3023 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	90.3678	89.8224	89.2877	86.7765	86.3066	84.1194	84.1194	83.7144	84.9619	86.3066	87.2571	88.2508 (38)
Heat transfer coeff	234.6701	234.1246	233.5900	231.0787	230.6089	228.4217	228.4217	228.0166	229.2642	230.6089	231.5594	232.5531 (39)
Average = Sum(39)m / 12 =												231.0765 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2266	1.2238	1.2106	1.2081	1.1967	1.1967	1.1946	1.2011	1.2081	1.2131	1.2183 (40)
HLP (average)												1.2106 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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 (59)
Heat gains from water heating, kWh/month	36.4717	31.8984	32.9163	28.6972	27.5356	23.7612	22.0182	25.2662	25.5680	29.7970	32.5258	35.3209 (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	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	149.5021	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6231	28.9756	23.5645	17.8399	13.3355	11.2584	12.1651	15.8126	21.2237	26.9484	31.4527	33.5298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.2933	366.0527	356.5790	336.4105	310.9514	287.0235	271.0381	267.2787	276.7524	296.9209	322.3800	346.3079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	37.9502	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	49.0211	47.4678	44.2423	39.8572	37.0103	33.0016	29.5944	33.9600	35.5111	40.0497	45.1747	47.4743	(72)
Total internal gains	511.7881	510.3467	492.2364	461.9582	429.1478	399.1341	380.6482	384.9019	401.3378	431.7696	466.8580	495.1627	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.8900	10.6334		0.6300		0.7000		0.7700		6.1419 (74)
East				21.3700	19.6403		0.6300		0.7000		0.7700		128.2696 (76)
South				2.4900	46.7521		0.6300		0.7000		0.7700		35.5772 (78)
West				11.4300	19.6403		0.6300		0.7000		0.7700		68.6065 (80)

Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635	(83)
Total gains	750.3833	965.4820	1220.6589	1502.9061	1693.3718	1689.9545	1610.8160	1447.9861	1240.5173	965.5782	762.0873	692.9262	(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	56.4859	56.6175	56.7471	57.3638	57.4807	58.0311	58.0311	58.1342	57.8178	57.4807	57.2447	57.0001	
alpha	4.7657	4.7745	4.7831	4.8243	4.8320	4.8687	4.8687	4.8756	4.8545	4.8320	4.8163	4.8000	
util living area	0.9997	0.9989	0.9951	0.9762	0.9102	0.7645	0.5988	0.6756	0.9127	0.9926	0.9993	0.9998	(86)
MIT	19.4631	19.6389	19.9453	20.3533	20.7062	20.9171	20.9802	20.9655	20.7808	20.2990	19.8048	19.4380	(87)
Th 2	19.8965	19.8988	19.9010	19.9115	19.9135	19.9227	19.9227	19.9244	19.9191	19.9135	19.9095	19.9054	(88)
util rest of house	0.9996	0.9985	0.9932	0.9661	0.8714	0.6719	0.4647	0.5405	0.8579	0.9883	0.9989	0.9997	(89)
MIT 2	18.4852	18.6626	18.9699	19.3799	19.7098	19.8835	19.9176	19.9141	19.7876	19.3324	18.8370	18.4671	(90)
Living area fraction									fLA = Living area / (4) =			0.1369	(91)
MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6191	18.7962	19.1034	19.5131	19.8462	20.0250	20.0630	20.0581	19.9235	19.4648	18.9695	18.6000	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9994	0.9979	0.9913	0.9613	0.8685	0.6817	0.4831	0.5588	0.8582	0.9858	0.9985	0.9996	(94)
Ext temp.	749.9234	963.4251	1209.9958	1444.7370	1470.7292	1152.1055	778.2149	809.1015	1064.5675	951.8191	760.9442	692.6405	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3360.2576	3253.4532	2944.0321	2452.4675	1878.5794	1239.1841	791.0345	834.1019	1335.1239	2044.2913	2748.4918	3348.7675	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1942.0886	1538.8989	1290.1230	725.5659	303.4405	0.0000	0.0000	0.0000	0.0000	812.7993	1431.0343	1976.1585	(98)
Space heating per m2												10020.1090	(98)
												(98) / (4) =	52.4943 (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	2147.1638	1690.3204	1732.9265	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8231	0.8940	0.8517	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1767.3076	1511.1832	1476.0148	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2114.0231	2018.1312	1830.7120	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	249.6352	377.1693	263.8947	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												890.6992 (104)
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	62.4088	94.2923	65.9737	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												222.6748 (107)
Space cooling per m2												1.1666 (108)
Energy for space heating												52.4943 (99)
Energy for space cooling												1.1666 (108)
Total												53.6609 (109)
Target Fabric Energy Efficiency (TFEE)												61.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
Effective ac	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

100.0000 (35)
35.4385 (36)
(33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	238.2428	237.1148	237.1148	235.5261	235.5261	233.6003	234.0611	233.1533	233.6003	234.5357	234.5357	236.0419 (39)
Average = Sum(39)m / 12 =												235.2544 (39)
HLP	1.2481	1.2422	1.2422	1.2339	1.2339	1.2238	1.2262	1.2215	1.2238	1.2287	1.2287	1.2366 (40)
HLP (average)												1.2325 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
RHI water heating demand												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	(72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.8900	11.9814	0.6300	0.7000	0.7700	6.9206 (74)			
East				21.3700	22.3313	0.6300	0.7000	0.7700	145.8447 (76)			
South				2.4900	50.9848	0.6300	0.7000	0.7700	38.7982 (78)			
West				11.4300	22.3313	0.6300	0.7000	0.7700	78.0068 (80)			
Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284 (83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305 (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	22.2555	22.3614	22.3614	22.5123	22.5123	22.6978	22.6531	22.7414	22.6978	22.6073	22.6073	22.4631
alpha	2.4837	2.4908	2.4908	2.5008	2.5008	2.5132	2.5102	2.5161	2.5132	2.5072	2.5072	2.4975
util living area	0.9637	0.9469	0.9073	0.8229	0.6921	0.4962	0.3492	0.3820	0.6512	0.8656	0.9443	0.9683 (86)
MIT	19.0694	19.2665	19.6665	20.1544	20.5535	20.7982	20.8669	20.8603	20.6840	20.1727	19.5506	19.0426 (87)
Th 2	19.8817	19.8864	19.8864	19.8930	19.8930	19.9010	19.8991	19.9029	19.9010	19.8971	19.8971	19.8908 (88)
util rest of house	0.9578	0.9383	0.8916	0.7924	0.6360	0.4064	0.2329	0.2612	0.5697	0.8348	0.9335	0.9631 (89)
MIT 2	17.3121	17.5991	18.1720	18.8582	19.3872	19.6762	19.7330	19.7336	19.5640	18.9033	18.0208	17.2796 (90)
Living area fraction									fLA = Living area / (4) =			0.1369 (91)
MIT	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9402	0.9166	0.8644	0.7640	0.6161	0.4001	0.2317	0.2595	0.5542	0.8057	0.9111	0.9470 (94)
Useful gains	1076.0931	1220.8923	1355.2921	1422.1007	1234.4649	829.7657	455.7783	473.8473	892.7878	1070.7179	1046.2149	1015.3998 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	2966.7542	2899.2788	2602.7151	2151.6715	1541.9577	894.6450	465.3653	486.7924	1055.2568	1753.6317	2399.3525	2931.8583 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	1406.6519	1127.8758	928.0827	525.2910	228.7746	0.0000	0.0000	0.0000	0.0000	508.0879	974.2591	1425.8452 (98)
Space heating												7124.8681 (98)
RHI space heating demand												7125 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	243.9994	243.3047	242.6238	239.4257	238.8274	236.0419	236.0419	235.5261	237.1148	238.8274	240.0378	241.3033 (39)
Average = Sum(39)m / 12 =												239.4228 (39)
HLP	1.2783	1.2746	1.2711	1.2543	1.2512	1.2366	1.2366	1.2339	1.2422	1.2512	1.2575	1.2642 (40)
HLP (average)												1.2543 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.8900	10.6334	0.6300	0.7000	0.7700		6.1419 (74)	
East					21.3700	19.6403	0.6300	0.7000	0.7700		128.2696 (76)	
South					2.4900	46.7521	0.6300	0.7000	0.7700		35.5772 (78)	
West					11.4300	19.6403	0.6300	0.7000	0.7700		68.6065 (80)	
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294	197.7635 (83)
Total gains	1113.6096	1324.2114	1564.7841	1826.0343	1995.5962	1975.0142	1887.4383	1730.6933	1536.8832	1283.0278	1101.7271	1048.7656 (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	21.7305	21.7925	21.8537	22.1456	22.2011	22.4631	22.4631	22.5123	22.3614	22.2011	22.0891	21.9733
alpha	2.4487	2.4528	2.4569	2.4764	2.4801	2.4975	2.4975	2.5008	2.4908	2.4801	2.4726	2.4649
util living area	0.9693	0.9526	0.9192	0.8525	0.7497	0.6135	0.4867	0.5360	0.7355	0.8956	0.9558	0.9733 (86)
MIT	18.8775	19.1037	19.4899	19.9837	20.4003	20.6890	20.8110	20.7866	20.5484	19.9868	19.3463	18.8432 (87)
Th 2	19.8579	19.8607	19.8636	19.8768	19.8793	19.8908	19.8908	19.8930	19.8864	19.8793	19.8742	19.8690 (88)
util rest of house	0.9644	0.9451	0.9060	0.8275	0.7050	0.5397	0.3839	0.4334	0.6720	0.8724	0.9475	0.9690 (89)
MIT 2	17.0181	17.3468	17.9036	18.6099	19.1782	19.5511	19.6817	19.6636	19.3909	18.6316	17.7110	16.9755 (90)
Living area fraction	17.2726	17.5873	18.1207	18.7980	19.3455	19.7069	19.8363	19.8173	19.5494	18.8171	17.9349	17.2312 (92)
MIT	17.2726	17.5873	18.1207	18.7980	19.3455	19.7069	19.8363	19.8173	19.5494	18.8171	17.9349	17.2312 (93)
Temperature adjustment												0.0000
adjusted MIT	17.2726	17.5873	18.1207	18.7980	19.3455	19.7069	19.8363	19.8173	19.5494	18.8171	17.9349	17.2312 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1056.1325	1223.9667	1376.2671	1457.3289	1357.7127	1038.9663	714.3189	736.7352	998.0283	1082.5081	1021.7421	1001.0331 (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	3165.3166	3086.8760	2819.4672	2369.8288	1825.9604	1205.4358	763.9098	804.8694	1292.1269	1962.4726	2600.7755	3144.4717 (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	1569.2329	1251.8750	1073.7409	656.9999	348.3763	0.0000	0.0000	0.0000	0.0000	654.6936	1136.9041	1594.7183 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 8286.5411 (98)
43.4123 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													224.4000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													3323.4790 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1569.2329	1251.8750	1073.7409	656.9999	348.3763	0.0000	0.0000	0.0000	0.0000	654.6936	1136.9041	1594.7183	(98)
Space heating efficiency (main heating system 1)	224.4000	224.4000	224.4000	224.4000	224.4000	0.0000	0.0000	0.0000	0.0000	224.4000	224.4000	224.4000	(210)
Space heating fuel (main heating system)	629.3715	502.0889	430.6447	263.5026	139.7231	0.0000	0.0000	0.0000	0.0000	262.5776	455.9776	639.5929	(211)
Water heating requirement	241.4205	192.5962	165.1909	101.0769	53.5964	0.0000	0.0000	0.0000	0.0000	100.7221	174.9083	245.3413	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	(216)
Fuel for water heating, kWh/month	100.2260	88.3377	92.7699	83.1563	81.4862	72.8049	69.9157	76.7270	76.5940	86.2285	91.1852	97.8126	(219)
Water heating fuel used												1017.2440	(219)
Annual totals kWh/year													
Space heating fuel - main system												3323.4790	(211)
Space heating fuel - secondary												1274.8525	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1068 * 1.00) =										-2136.1410		-2136.1410	(233)
Total delivered energy for all uses												4085.5690	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3323.4790	13.1900	438.3669	(240)
Space heating - secondary	1274.8525	4.2300	53.9263	(242)
Water heating (other fuel)	1017.2440	13.1900	134.1745	(247)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Energy for lighting	576.1345	13.1900	75.9921	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-2136.1410	13.1900	-281.7570	(252)
Total energy cost			424.6598	(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] =	0.7561 (257)
SAP value	89.4519	
SAP rating (Section 12)	89	(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	3323.4790	0.5190	1724.8856	(261)
Space heating - secondary	1274.8525	0.0190	24.2222	(263)
Water heating (other fuel)	1017.2440	0.5190	527.9496	(264)
Space and water heating			2277.0575	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Energy saving/generation technologies				
PV Unit	-2136.1410	0.5190	-1108.6572	(269)
Total kg/year			1482.9841	(272)
CO2 emissions per m2			7.7700	(273)
EI value			91.5754	
EI rating			92	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW	

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 2.2440 = 6.304$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 2.2440 = 0.2481$, stars = 4
Water heating energy efficiency	$13.19 / 2.2440 = 5.878$, stars = 3
Water heating environmental impact	$0.519 / 2.2440 = 0.2313$, stars = 4

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

100.0000 (35)
35.4385 (36)
(33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	238.2428	237.1148	237.1148	235.5261	235.5261	233.6003	234.0611	233.1533	233.6003	234.5357	234.5357	236.0419 (39)
Average = Sum(39)m / 12 =												235.2544 (39)
HLP	1.2481	1.2422	1.2422	1.2339	1.2339	1.2238	1.2262	1.2215	1.2238	1.2287	1.2287	1.2366 (40)
HLP (average)												1.2325 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915 (64)
Total per year (kWh/year) = Sum(64)m =												2282.6956 (64)
Heat gains from water heating, kWh/month	99.6879	86.4075	94.1248	86.1483	85.7057	78.4249	77.0725	82.1547	81.2520	89.2441	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303 (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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017 (71)
Water heating gains (Table 5)	133.9892	131.5588	126.5118	119.6504	115.1958	108.9234	103.5921	110.4230	112.8500	119.9517	127.9707	131.5689 (72)
Total internal gains	875.0143	869.0762	836.3616	785.0864	731.3723	684.1938	657.2705	667.6091	697.7037	749.2192	806.4977	851.0021 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North					1.8900	11.9814	0.6300		0.7000		0.7700		6.9206 (74)
East					21.3700	22.3313	0.6300		0.7000		0.7700		145.8447 (76)
South					2.4900	50.9848	0.6300		0.7000		0.7700		38.7982 (78)
West					11.4300	22.3313	0.6300		0.7000		0.7700		78.0068 (80)

Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284	(83)
Total gains	1144.5846	1332.0067	1567.9827	1861.2757	2003.5477	2073.8106	1967.4532	1826.2577	1610.9360	1328.9313	1148.2845	1072.2305	(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	22.2555	22.3614	22.3614	22.5123	22.5123	22.6978	22.6531	22.7414	22.6978	22.6073	22.6073	22.4631
alpha	2.4837	2.4908	2.4908	2.5008	2.5008	2.5132	2.5102	2.5161	2.5132	2.5072	2.5072	2.4975
util living area	0.9637	0.9469	0.9073	0.8229	0.6921	0.4962	0.3492	0.3820	0.6512	0.8656	0.9443	0.9683 (86)
MIT	19.0694	19.2665	19.6665	20.1544	20.5535	20.7982	20.8669	20.8603	20.6840	20.1727	19.5506	19.0426 (87)
Th 2	19.8817	19.8864	19.8864	19.8930	19.8930	19.9010	19.8991	19.9029	19.9010	19.8971	19.8971	19.8908 (88)
util rest of house	0.9578	0.9383	0.8916	0.7924	0.6360	0.4064	0.2329	0.2612	0.5697	0.8348	0.9335	0.9631 (89)
MIT 2	17.3121	17.5991	18.1720	18.8582	19.3872	19.6762	19.7336	19.7336	19.5640	18.9033	18.0208	17.2796 (90)
Living area fraction	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209 (92)
MIT	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209 (93)
Temperature adjustment												0.0000
adjusted MIT	17.5527	17.8273	18.3766	19.0356	19.5469	19.8298	19.8882	19.8879	19.7174	19.0770	18.2302	17.5209 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1076.0931	1220.8923	1355.2921	1422.1007	1234.4649	829.7657	455.7783	473.8473	892.7878	1070.7179	1046.2149	1015.3998 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	2966.7542	2899.2788	2602.7151	2151.6715	1541.9577	894.6450	465.3653	486.7924	1055.2568	1753.6317	2399.3525	2931.8583 (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	1406.6519	1127.8758	928.0827	525.2910	228.7746	0.0000	0.0000	0.0000	0.0000	508.0879	974.2591	1425.8452 (98)

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Space heating 7124.8681 (98)
Space heating per m2 (98) / (4) = 37.3264 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													224.4000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													2857.5674 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1406.6519	1127.8758	928.0827	525.2910	228.7746	0.0000	0.0000	0.0000	0.0000	508.0879	974.2591	1425.8452	(98)
Space heating efficiency (main heating system 1)	224.4000	224.4000	224.4000	224.4000	224.4000	0.0000	0.0000	0.0000	0.0000	224.4000	224.4000	224.4000	(210)
Space heating fuel (main heating system)	564.1652	452.3566	372.2257	210.6782	91.7545	0.0000	0.0000	0.0000	0.0000	203.7786	390.7456	571.8630	(211)
Water heating requirement	216.4080	173.5193	142.7820	80.8140	35.1961	0.0000	0.0000	0.0000	0.0000	78.1674	149.8860	219.3608	(215)
Water heating requirement	224.9071	198.2299	208.1757	186.6027	182.8551	163.3743	156.8907	172.1755	171.8769	193.4968	204.6195	219.4915	(64)
Efficiency of water heater (217)m	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	(216)
Fuel for water heating, kWh/month	100.2260	88.3377	92.7699	83.1563	81.4862	72.8049	69.9157	76.7270	76.5940	86.2285	91.1852	97.8126	(219)
Water heating fuel used												1017.2440	(219)
Annual totals kWh/year													
Space heating fuel - main system												2857.5674	(211)
Space heating fuel - secondary												1096.1335	(215)
Electricity for pumps and fans: central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												576.1345	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1121 * 1.00) =										-2241.9563		-2241.9563	(233)
Total delivered energy for all uses												3335.1231	(238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2857.5674	17.5600	501.7888	(240)
Space heating - secondary	1096.1335	4.6500	50.9702	(242)
Water heating (other fuel)	1017.2440	17.5600	178.6281	(247)
Pumps and fans for heating	30.0000	17.5600	5.2680	(249)
Energy for lighting	576.1345	17.5600	101.1692	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-2241.9563	17.5600	-393.6875	(252)
Total energy cost			444.1368	(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	2857.5674	0.5190	1483.0775	(261)
Space heating - secondary	1096.1335	0.0190	20.8265	(263)
Water heating (other fuel)	1017.2440	0.5190	527.9496	(264)
Space and water heating			2031.8537	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	576.1345	0.5190	299.0138	(268)
Energy saving/generation technologies				
PV Unit	-2241.9563	0.5190	-1163.5753	(269)
Total kg/year			1182.8621	(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	2857.5674	3.0700	8772.7319	(261)
Space heating - secondary	1096.1335	1.0400	1139.9789	(263)
Water heating (other fuel)	1017.2440	3.0700	3122.9391	(264)
Space and water heating			13035.6500	(265)
Pumps and fans	30.0000	3.0700	92.1000	(267)
Energy for lighting	576.1345	3.0700	1768.7328	(268)

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Energy saving/generation technologies			
PV Unit	-2241.9563	3.0700	-6882.8059 (269)
Primary energy kWh/year			8013.6769 (272)
Primary energy kWh/m ² /year			41.9828 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: A 92

(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	Already installed
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	Recommended
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 67	-198 kg (16.8%)
V2 Wind turbine	+ 11.7	-£ 628	-1856 kg (188.5%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£67	1.04 kg/m ²	B 91 A 93
Wind turbine	£628	9.72 kg/m ²	A 102 A 103
Total Savings	£695	10.76 kg/m ²	

Potential energy efficiency rating: A 102
Potential environmental impact rating: A 103

Fuel prices for cost data on this page from database revision number 445 TEST (30 Jul 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£787	£720	£67
Wood	£51	£51	-£0
Space heating	£558	£558	-£0
Water heating	£179	£111	£67
Lighting	£101	£101	£0
Generated (PV)	-£394	-£394	£0
Generated (wind)	-£0	-£628	£628
Total cost of fuels	£444	-£251	£695
Total cost of uses	£444	-£252	£695
Delivered energy	17 kWh/m ²	-3 kWh/m ²	21 kWh/m ²
Carbon dioxide emissions	1.2 tonnes	-0.9 tonnes	2.1 tonnes
CO2 emissions per m ²	6 kg/m ²	-5 kg/m ²	11 kg/m ²
Primary energy	42 kWh/m ²	-22 kWh/m ²	64 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4841	0.4746	0.4652	0.4177	0.4082	0.3607	0.3607	0.3512	0.3797	0.4082	0.4272	0.4462 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5651	0.5651	0.5617	0.5721	0.5833	0.5912	0.5995 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.4385 (36)
Total fabric heat loss (33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	94.2099	93.5152	92.8343	89.6362	89.0379	86.2524	86.2524	85.7366	87.3253	89.0379	90.2483	91.5138 (38)
Heat transfer coeff	243.9994	243.3047	242.6238	239.4257	238.8274	236.0419	236.0419	235.5261	237.1148	238.8274	240.0378	241.3033 (39)
Average = Sum(39)m / 12 =												239.4228 (39)
HLP	1.2783	1.2746	1.2711	1.2543	1.2512	1.2366	1.2366	1.2339	1.2422	1.2512	1.2575	1.2642 (40)
HLP (average)												1.2543 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (56)
If cylinder contains dedicated solar storage	30.0132	27.1087	30.0132	29.0450	30.0132	29.0450	30.0132	30.0132	29.0450	30.0132	29.0450	30.0132 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	206.7799	179.8491	170.0608	150.7676	143.8638	160.0790	166.4741	192.1011	204.6195	219.4915 (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												1.0956 (H8)
Utilisation factor												0.5986 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												0.7128 (H15)
Solar storage volume factor												0.9323 (H16)
Solar input												-889.9440 (H17)
Solar input	-25.8066	-43.0638	-73.3426	-98.2935	-121.4334	-119.3883	-117.8106	-102.9317	-80.6162	-55.0513	-30.6103	-21.5957 (63)
Solar input (sum of months) = Sum(63)m =												-889.9440 (63)
Output from w/h	199.1005	155.1661	133.4373	81.5555	48.6274	31.3792	26.0532	57.1473	85.8579	137.0498	174.0091	197.8958 (64)
Total per year (kWh/year) = Sum(64)m =												1327.2792 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	93.0082	80.7454	75.4702	68.3395	66.6510	72.4775	76.9297	88.1275	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	125.0110	112.1464	101.4385	94.9160	89.5846	97.4160	106.8468	118.4509	127.9707	131.5689	(72)
Total internal gains	875.0143	869.0762	834.8608	777.5824	717.6149	670.1863	643.2630	654.6022	691.7005	747.7184	806.4977	851.0021	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W
North					1.8900	10.6334	0.6300	0.7000				0.7700			6.1419 (74)
East					21.3700	19.6403	0.6300	0.7000				0.7700			128.2696 (76)
South					2.4900	46.7521	0.6300	0.7000				0.7700			35.5772 (78)
West					11.4300	19.6403	0.6300	0.7000				0.7700			68.6065 (80)
Solar gains	238.5952	455.1353	728.4225	1040.9479	1264.2240	1290.8204	1230.1678	1063.0842	839.1795	533.8086	295.2294				197.7635 (83)
Total gains	1113.6096	1324.2114	1563.2833	1818.5303	1981.8389	1961.0067	1873.4308	1717.6864	1530.8800	1281.5270	1101.7271				1048.7656 (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	21.7305	21.7925	21.8537	22.1456	22.2011	22.4631	22.4631	22.5123	22.3614	22.2011	22.0891	21.9733
alpha	2.4487	2.4528	2.4569	2.4764	2.4801	2.4975	2.4975	2.5008	2.4908	2.4801	2.4726	2.4649
util living area	0.9693	0.9526	0.9194	0.8535	0.7520	0.6163	0.4895	0.5389	0.7368	0.8958	0.9558	0.9733 (86)
MIT	18.8775	19.1037	19.4892	19.9806	20.3964	20.6869	20.8100	20.7853	20.5468	19.9861	19.3463	18.8432 (87)
Th 2	19.8579	19.8607	19.8636	19.8768	19.8793	19.8908	19.8908	19.8930	19.8864	19.8793	19.8742	19.8690 (88)
util rest of house	0.9644	0.9451	0.9062	0.8286	0.7075	0.5424	0.3864	0.4361	0.6735	0.8727	0.9475	0.9690 (89)
MIT 2	17.0181	17.3468	17.9025	18.6057	19.1735	19.5489	19.6810	19.6626	19.3891	18.6306	17.7110	16.9755 (90)
Living area fraction												fLA = Living area / (4) = 0.1369 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT	17.2726	17.5873	18.1197	18.7940	19.3409	19.7047	19.8355	19.8163	19.5476	18.8162	17.9349	17.2312 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2726	17.5873	18.1197	18.7940	19.3409	19.7047	19.8355	19.8163	19.5476	18.8162	17.9349	17.2312 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9484	0.9243	0.8797	0.7992	0.6827	0.5286	0.3808	0.4282	0.6507	0.8440	0.9274	0.9545 (94)	
Useful gains	1056.1325	1223.9667	1375.2301	1453.3480	1352.9782	1036.6380	713.4323	735.5682	996.2193	1081.5841	1021.7421	1001.0331 (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	3165.3166	3086.8760	2819.2136	2368.8675	1824.8563	1204.9242	763.7190	804.6164	1291.7089	1962.2482	2600.7755	3144.4717 (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	1569.2329	1251.8750	1074.3237	659.1741	351.0774	0.0000	0.0000	0.0000	0.0000	655.2141	1136.9041	1594.7183 (98)	
Space heating												8292.5196 (98)	
Space heating per m2												(98) / (4) = 43.4436 (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)	0.1000 (201)
Fraction of space heat from main system(s)	0.9000 (202)
Efficiency of main space heating system 1 (in %)	224.4000 (206)
Efficiency of secondary/supplementary heating system, %	65.0000 (208)
Space heating requirement	3325.8768 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1569.2329	1251.8750	1074.3237	659.1741	351.0774	0.0000	0.0000	0.0000	0.0000	655.2141	1136.9041	1594.7183 (98)	
Space heating efficiency (main heating system 1)	224.4000	224.4000	224.4000	224.4000	224.4000	0.0000	0.0000	0.0000	0.0000	224.4000	224.4000	224.4000 (210)	
Space heating fuel (main heating system)	629.3715	502.0889	430.8785	264.3746	140.8064	0.0000	0.0000	0.0000	0.0000	262.7864	455.9776	639.5929 (211)	
Water heating requirement	241.4205	192.5962	165.2806	101.4114	54.0119	0.0000	0.0000	0.0000	0.0000	100.8022	174.9083	245.3413 (215)	
Water heating													
Water heating requirement	199.1005	155.1661	133.4373	81.5555	48.6274	31.3792	26.0532	57.1473	85.8579	137.0498	174.0091	197.8958 (64)	
Efficiency of water heater (217)m	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000	224.4000 (216)	
Fuel for water heating, kWh/month	88.7257	69.1471	59.4640	36.3438	21.6700	13.9836	11.6102	25.4667	38.2611	61.0739	77.5442	88.1889 (219)	
Water heating fuel used												591.4791 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3325.8768 (211)	
Space heating fuel - secondary												1275.7722 (215)	

Electricity for pumps and fans:													
central heating pump												30.0000 (230c)	
pump for solar water heating												50.0000 (230g)	
Total electricity for the above, kWh/year												80.0000 (231)	
Electricity for lighting (calculated in Appendix L)												576.1345 (232)	

Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1068 * 1.00) =									-2136.1410			-2136.1410 (233)	
Wind generation												-3575.5408 (234)	
Total delivered energy for all uses												137.5810 (238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3325.8768	13.1900	438.6832 (240)	
Space heating - secondary	1275.7722	4.2300	53.9652 (242)	
Water heating (other fuel)	591.4791	13.1900	78.0161 (247)	
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)	
Pump for solar water heating	50.0000	13.1900	6.5950 (249)	
Energy for lighting	576.1345	13.1900	75.9921 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-2136.1410	13.1900	-281.7570 (252)	
Wind Turbine	-3575.5408	13.1900	-471.6138 (252)	
Total energy cost			-96.1623 (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] =	-0.1712 (257)
SAP value		102.3886
SAP rating (Section 12)		102 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP band

A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3325.8768	0.5190	1726.1301 (261)
Space heating - secondary	1275.7722	0.0190	24.2397 (263)
Water heating (other fuel)	591.4791	0.5190	306.9777 (264)
Space and water heating			2057.3474 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Energy saving/generation technologies			
PV Unit	-2136.1410	0.5190	-1108.6572 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-566.4816 (272)
CO2 emissions per m2			-2.9700 (273)
EI value			103.2181
EI rating			103 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.0800 (1b)	x 2.4000 (2b)	= 244.9920 (1b) - (3b)
First floor	88.8000 (1c)	x 2.4500 (2c)	= 217.5600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	190.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 462.5520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1297 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3797 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3987	0.3797	0.3797	0.3512	0.3512	0.3133	0.3228	0.3038	0.3133	0.3323	0.3323	0.3607 (22b)
	0.5795	0.5721	0.5721	0.5617	0.5617	0.5491	0.5521	0.5461	0.5491	0.5552	0.5552	0.5651 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2400	1.1000	4.6640		(26a)
Windows (Uw = 1.10)			37.1800	1.0536	39.1743		(27)
Ground Floor			102.0800	0.1200	12.2496		(28a)
Brick and Block	140.3000	29.0500	111.2500	0.2300	25.5875		(29a)
Clad Walls	53.3300	6.7400	46.5900	0.2300	10.7157		(29a)
Dormers	12.0300	5.6300	6.4000	0.2200	1.4080		(29a)
Stud to Loft Void	17.9800		17.9800	0.2400	4.3152		(29a)
Pitched Roof	74.0600		74.0600	0.1000	7.4060		(30)
Sloping Ceilings	35.6300		35.6300	0.1800	6.4134		(30)
Flat Roof	7.1700		7.1700	0.1800	1.2906		(30)
Pitched (Room in Roof)	11.8300		11.8300	0.0952	1.1267		(30)
Total net area of external elements Aum(A, m ²)			454.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.3510		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

100.0000 (35)
35.4385 (36)
(33) + (36) = 149.7895 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	88.4533	87.3253	87.3253	85.7366	85.7366	83.8108	84.2716	83.3638	83.8108	84.7462	84.7462	86.2524 (38)
Heat transfer coeff	238.2428	237.1148	237.1148	235.5261	235.5261	233.6003	234.0611	233.1533	233.6003	234.5357	234.5357	236.0419 (39)
Average = Sum(39)m / 12 =												235.2544 (39)
HLP	1.2481	1.2422	1.2422	1.2339	1.2339	1.2238	1.2262	1.2215	1.2238	1.2287	1.2287	1.2366 (40)
HLP (average)												1.2325 (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												2.9900 (42)
Average daily hot water use (litres/day)												105.2135 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7349	111.5263	107.3178	103.1092	98.9007	94.6922	94.6922	98.9007	103.1092	107.3178	111.5263	115.7349 (44)
Energy conte	171.6315	150.1100	154.9000	135.0456	129.5795	111.8172	103.6151	118.8998	120.3199	140.2212	153.0624	166.2159 (45)
Energy content (annual)										Total = Sum(45)m =		1655.4182 (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

Distribution loss (46)m = 0.15 x (45)m	25.7447	22.5165	23.2350	20.2568	19.4369	16.7726	15.5423	17.8350	18.0480	21.0332	22.9594	24.9324 (46)
Water storage loss:												
Store volume												210.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8298 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9682 (55)
Total storage loss												
30.0132 27.1087 30.0132 29.0450 30.0132 29.0450 30.0132 30.0132 29.0450 30.0132 29.0450 30.0132 (56)												
If cylinder contains dedicated solar storage												
30.0132 27.1087 30.0132 29.0450 30.0132 29.0450 30.0132 30.0132 29.0450 30.0132 29.0450 30.0132 (57)												
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	224.9071	198.2299	206.7799	179.8491	170.0608	150.7676	143.8638	160.0790	166.4741	192.1011	204.6195	219.4915 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1570 (H8)
Utilisation factor												0.5786 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												105.2135 (H14)
Volume ratio Veff/V												0.7128 (H15)
Solar storage volume factor												0.9323 (H16)
Solar input												-908.5616 (H17)
Solar input	-27.9651	-42.0314	-70.7863	-97.8483	-117.8423	-124.0239	-121.0458	-108.0946	-84.3682	-57.3941	-33.9923	-23.1692 (63)
Solar input (sum of months) = Sum(63)m =												-908.5616 (63)
Output from w/h	196.9420	156.1984	135.9936	82.0007	52.2185	26.7437	22.8180	51.9844	82.1058	134.7070	170.6272	196.3223 (64)
Total per year (kWh/year) = Sum(64)m =												1308.6616 (64)
Heat gains from water heating, kWh/month	99.6879	88.4075	93.0082	80.7454	75.4702	68.3395	66.6510	72.4775	76.9297	88.1275	92.1389	97.8873 (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	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	179.4026	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.5578	72.4389	58.9113	44.5996	33.3387	28.1460	30.4127	39.5316	53.0592	67.3709	78.6318	83.8245	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	540.7362	546.3473	532.2074	502.1052	464.1066	428.3932	404.5345	398.9234	413.0633	443.1655	481.1641	516.8775	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	55.9303	(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)	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	-119.6017	(71)
Water heating gains (Table 5)	133.9892	131.5588	125.0110	112.1464	101.4385	94.9160	89.5846	97.4160	106.8468	118.4509	127.9707	131.5689	(72)
Total internal gains	875.0143	869.0762	834.8608	777.5824	717.6149	670.1863	643.2630	654.6022	691.7005	747.7184	806.4977	851.0021	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				1.8900	11.9814		0.6300		0.7000		0.7700		6.9206 (74)	
East				21.3700	22.3313		0.6300		0.7000		0.7700		145.8447 (76)	
South				2.4900	50.9848		0.6300		0.7000		0.7700		38.7982 (78)	
West				11.4300	22.3313		0.6300		0.7000		0.7700		78.0068 (80)	
Solar gains	269.5703	462.9305	731.6211	1076.1893	1272.1754	1389.6168	1310.1827	1158.6487	913.2323	579.7121	341.7867	221.2284	(83)	
Total gains	1144.5846	1332.0067	1566.4819	1853.7717	1989.7903	2059.8031	1953.4457	1813.2508	1604.9328	1327.4305	1148.2845	1072.2305	(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	22.2555	22.3614	22.3614	22.5123	22.5123	22.6978	22.6531	22.7414	22.6978	22.6073	22.6073	22.4631
alpha	2.4837	2.4908	2.4908	2.5008	2.5008	2.5132	2.5102	2.5161	2.5132	2.5072	2.5072	2.4975
util living area	0.9637	0.9469	0.9074	0.8241	0.6946	0.4987	0.3514	0.3843	0.6526	0.8658	0.9443	0.9683 (86)
MIT	19.0694	19.2665	19.6658	20.1516	20.5504	20.7971	20.8665	20.8598	20.6829	20.1720	19.5506	19.0426 (87)
Th 2	19.8817	19.8864	19.8864	19.8930	19.8930	19.9010	19.8991	19.9029	19.9010	19.8971	19.8971	19.8908 (88)
util rest of house	0.9578	0.9383	0.8918	0.7936	0.6387	0.4087	0.2345	0.2630	0.5712	0.8351	0.9335	0.9631 (89)
MIT 2	17.3121	17.5991	18.1710	18.8545	19.3837	19.6753	19.7328	19.7334	19.5630	18.9024	18.0208	17.2796 (90)
Living area fraction												
										fLA = Living area / (4) =		0.1369 (91)

MIT	17.5527	17.8273	18.3756	19.0321	19.5434	19.8289	19.8880	19.8876	19.7163	19.0762	18.2302	17.5209 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5527	17.8273	18.3756	19.0321	19.5434	19.8289	19.8880	19.8876	19.7163	19.0762	18.2302	17.5209 (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

Water heating (other fuel)	583.1825	0.5190	302.6717 (264)
Space and water heating			1807.6333 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	576.1345	0.5190	299.0138 (268)
Energy saving/generation technologies			
PV Unit	-2241.9563	0.5190	-1163.5753 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-871.1139 (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	2859.5768	3.0700	8778.9009 (261)
Space heating - secondary	1096.9043	1.0400	1140.7805 (263)
Water heating (other fuel)	583.1825	3.0700	1790.3704 (264)
Space and water heating			11710.0518 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	576.1345	3.0700	1768.7328 (268)
Energy saving/generation technologies			
PV Unit	-2241.9563	3.0700	-6882.8059 (269)
Wind Turbine	-3575.5408	3.0700	-10976.9101 (269)
Primary energy kWh/year			-4135.3314 (272)
Primary energy kWh/m2/year			-21.6646 (273)