

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-155			Issued on Date	26/03/2024
Assessment Reference	As Built	Prop Type Ref	FLv1 Det As		
Property	30, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	88 B	DER	12.11	TER	15.36
Environmental	88 B	% DER<TER	21.18		
CO ₂ Emissions (t/year)	1.64	DFEE	48.23	TFEE	57.02
General Requirements Compliance	Pass	% DFEE<TFEE	15.42		
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk			Assessor ID	T510-0001
Client	Drew Smith				

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

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DWELLING AS BUILT

Detached House, total floor area 171 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) 15.36 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.11 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.32 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.17 (max. 0.20)	0.28 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.80 (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: 4.85 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC HEAT H15

Efficiency: 89.4% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.40 kWh/day
Permitted by DBSCG 2.10 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

Continuous extract system (decentralised)
Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:
Average
Windows facing North: 4.02 m², No overhang
Windows facing East: 12.31 m², No overhang
Windows facing West: 12.91 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

External wall U-value 0.14 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.96 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	65.4500 (1b)	x 2.4000 (2b)	= 157.0800 (1b) - (3b)
First floor	64.4100 (1c)	x 2.6900 (2c)	= 173.2629 (1c) - (3c)
Second floor	40.9400 (1d)	x 2.3900 (2d)	= 97.8466 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	170.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 428.1895 (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							0 * 10 =	0.0000 (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) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							4.8500					
Infiltration rate							0.2425	(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) =	0.2425 (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)
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												
	0.3092	0.3031	0.2971	0.2668	0.2607	0.2304	0.2304	0.2243	0.2425	0.2607	0.2728	0.2849 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5592	0.5531	0.5471	0.5168	0.5107	0.5000	0.5000	0.5000	0.5000	0.5107	0.5228	0.5349 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid Door			4.2500	1.3000	5.5250			(26)					
Window (Uw = 1.40)			24.0200	1.3258	31.8447			(27)					
French Door (Uw = 1.40)			5.2200	1.3258	6.9205			(27)					
Roof Window (Uw = 1.80)			0.9000	1.6791	1.5112			(27a)					
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000	(28a)					
140mm Timber Frame	193.8600	29.9000	163.9600	0.1900	31.1524	9.0000	1475.6400	(29a)					
W2V	14.8500		14.8500	0.1400	2.0790	18.0000	267.3000	(29a)					
Dormer Cheek	11.9700	3.5900	8.3800	0.3200	2.6816	18.0000	150.8400	(29a)					
400mm Mineral Wool	14.7000		14.7000	0.1100	1.6170	9.0000	132.3000	(30)					
Bay Flat	1.0500		1.0500	0.2500	0.2625	9.0000	9.4500	(30)					
Sloping	23.4900	0.9000	22.5900	0.2000	4.5180	9.0000	203.3100	(30)					
Dormer Roof	8.5000		8.5000	0.2800	2.3800	9.0000	76.5000	(30)					
C2V	23.4700		23.4700	0.1400	3.2858	9.0000	211.2300	(30)					
Total net area of external elements Aum(A, m2)			343.2500					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	103.0224			(33)					
Timber GF			114.3800			9.0000	1029.4200	(32c)					
Timber FF			133.7300			9.0000	1203.5700	(32c)					
Timber 2F			56.7900			9.0000	511.1100	(32c)					
Internal Floor			64.4100			18.0000	1159.3800	(32d)					
Internal Floor 2			40.9400			18.0000	736.9200	(32d)					
Internal Ceiling			64.4100			18.0000	1159.3800	(32e)					
Internal Ceiling 2			40.9400			18.0000	736.9200	(32e)					
Heat capacity Cm = Sum(A x k)				(28) ... (30) + (32) + (32a) ... (32e) =			12915.2700	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							75.6163	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.9013	(36)					
Total fabric heat loss				(33) + (36) =			124.9237	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	79.0146	78.1580	77.3013	73.0181	72.1614	70.6513	70.6513	70.6513	70.6513	72.1614	73.8747	75.5880	(38)
Average = Sum(39)m / 12 =	203.9383	203.0817	202.2250	197.9418	197.0852	195.5750	195.5750	195.5750	195.5750	197.0852	198.7984	200.5117	(39)
												198.5806	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1940	1.1890	1.1840	1.1589	1.1539	1.1451	1.1451	1.1451	1.1451	1.1539	1.1639	1.1740	(40)
Days in month												1.1626	(40)
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy

2.9636 (42)

Average daily hot water use (litres/day)

104.5865 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.0452	110.8617	106.6783	102.4948	98.3113	94.1279	94.1279	98.3113	102.4948	106.6783	110.8617	115.0452
Energy content (annual)	170.6087	149.2154	153.9770	134.2409	128.8073	111.1509	102.9976	118.1913	119.6029	139.3856	152.1503	165.2254
Energy content (annual)										Total =	Sum (45)m =	1645.5533
Distribution loss (46)m = 0.15 x (45)m	25.5913	22.3823	23.0965	20.1361	19.3211	16.6726	15.4496	17.7287	17.9404	20.9078	22.8225	24.7838
Water storage loss:												
Store volume												180.0000
a) If manufacturer declared loss factor is known (kWh/day):												1.4000
Temperature factor from Table 2b												0.5400
Enter (49) or (54) in (55)												0.7560
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360
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
Total heat required for water heating calculated for each month	217.3071	191.3946	200.6754	179.4329	175.5057	156.3429	149.6960	164.8897	164.7949	186.0840	197.3423	211.9238
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
								Solar input (sum of months)	Sum (63)m =			0.0000
Output from w/h	217.3071	191.3946	200.6754	179.4329	175.5057	156.3429	149.6960	164.8897	164.7949	186.0840	197.3423	211.9238
								Total per year (kWh/year)	Sum (64)m =			2195.3893
Heat gains from water heating, kWh/month	94.0861	83.3575	88.5561	80.7887	80.1871	73.1113	71.6054	76.6573	75.9216	83.7044	86.7436	92.2962

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	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.2436	27.7503	22.5680	17.0855	12.7716	10.7823	11.6507	15.1440	20.3262	25.8088	30.1227	32.1119	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	342.3647	345.9174	336.9648	317.9057	293.8470	271.2353	256.1292	252.5766	261.5292	280.5883	304.6469	327.2587	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	(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)	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	(71)
Water heating gains (Table 5)	126.4598	124.0439	119.0270	112.2065	107.7784	101.5434	96.2439	103.0340	105.4466	112.5060	120.4772	124.0540	(72)
Total internal gains	570.5228	568.1662	549.0144	517.6523	484.8517	454.0157	434.4784	441.2092	457.7566	489.3577	525.7014	553.8792	(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	4.0200	10.6334	0.7200	0.7000	0.7700	14.9301 (74)
East	7.0900	19.6403	0.7200	0.7000	0.7700	48.6359 (76)
West	12.9100	19.6403	0.7200	0.7000	0.7700	88.5599 (80)
East	5.2200	19.6403	0.7200	0.7000	0.7700	35.8081 (76)
East	0.9000	26.0000	0.6300	0.7000	1.0000	9.2875 (82)

Solar gains	197.2215	386.2540	640.1254	944.3197	1169.6836	1203.5281	1143.2369	973.2336	747.5928	459.1183	245.9217	162.2179 (83)
Total gains	767.7443	954.4202	1189.1398	1461.9720	1654.5353	1657.5438	1577.7153	1414.4428	1205.3495	948.4760	771.6232	716.0972 (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	17.5915	17.6657	17.7405	18.1244	18.2032	18.3437	18.3437	18.3437	18.3437	18.2032	18.0463	17.8921
alpha	2.1728	2.1777	2.1827	2.2083	2.2135	2.2229	2.2229	2.2229	2.2229	2.2135	2.2031	2.1928
util living area	0.9693	0.9505	0.9121	0.8352	0.7233	0.5888	0.4703	0.5257	0.7277	0.8935	0.9559	0.9734 (86)
MIT	17.7947	18.1493	18.7660	19.5660	20.2214	20.6614	20.8545	20.8083	20.4198	19.5286	18.5308	17.7568 (87)
Th 2	19.9248	19.9288	19.9328	19.9530	19.9571	19.9642	19.9642	19.9642	19.9642	19.9571	19.9490	19.9409 (88)
util rest of house	0.9652	0.9439	0.9001	0.8123	0.6831	0.5239	0.3800	0.4351	0.6724	0.8736	0.9490	0.9698 (89)
MIT 2	15.6221	16.1358	17.0242	18.1663	19.0672	19.6395	19.8593	19.8174	19.3597	18.1392	16.7013	15.5721 (90)
Living area fraction									fLA =	Living area /	(4) =	0.1011 (91)
MIT	15.8418	16.3394	17.2003	18.3078	19.1839	19.7429	19.9599	19.9176	19.4669	18.2797	16.8863	15.7930 (92)
Temperature adjustment												-0.1500
adjusted MIT	15.6918	16.1894	17.0503	18.1578	19.0339	19.5929	19.8099	19.7676	19.3169	18.1297	16.7363	15.6430 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9378	0.9077	0.8537	0.7618	0.6412	0.4979	0.3653	0.4159	0.6306	0.8243	0.9148	0.9451	(94)
Useful gains	719.9578	866.3622	1015.1102	1113.7950	1060.8303	825.2466	576.4163	588.2794	760.0934	781.8739	705.8952	676.8097	(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													
	2323.2221	2292.6743	2133.5407	1832.5080	1445.3948	976.4796	627.7846	658.6228	1020.3017	1483.9915	1915.6870	2294.4624	(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	1192.8286	958.4817	832.1123	517.4734	286.1160	0.0000	0.0000	0.0000	0.0000	522.3755	871.0501	1203.5336	(98)
Space heating													
Space heating per m2													(98) / (4) = 37.3769 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7061.9150 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1192.8286	958.4817	832.1123	517.4734	286.1160	0.0000	0.0000	0.0000	0.0000	522.3755	871.0501	1203.5336	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	1319.5006	1060.2674	920.4782	572.4263	316.5000	0.0000	0.0000	0.0000	0.0000	577.8490	963.5510	1331.3425	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	217.3071	191.3946	200.6754	179.4329	175.5057	156.3429	149.6960	164.8897	164.7949	186.0840	197.3423	211.9238	(64)
Efficiency of water heater	88.5676	88.4241	88.1018	87.3796	86.0099	79.7000	79.7000	79.7000	79.7000	87.3208	88.2125	88.6187	(217)
Fuel for water heating, kWh/month	245.3572	216.4509	227.7768	205.3487	204.0530	196.1642	187.8244	206.8880	206.7690	213.1039	223.7124	239.1411	(219)
Water heating fuel used												2572.5895	(219)
Annual totals kWh/year													
Space heating fuel - main system												7061.9150	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)													
mechanical ventilation fans (SFP = 0.2308)													120.5738 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													195.5738 (231)
Electricity for lighting (calculated in Appendix L)													551.7714 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.96 * 1004 * 1.00) =										-771.0691		-771.0691	(233)
Total delivered energy for all uses												9610.7806	(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	7061.9150	0.2160	1525.3736	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2572.5895	0.2160	555.6793	(264)
Space and water heating			2081.0530	(265)
Pumps and fans	195.5738	0.5190	101.5028	(267)
Energy for lighting	551.7714	0.5190	286.3693	(268)
Energy saving/generation technologies				
PV Unit	-771.0691	0.5190	-400.1849	(269)
Total CO2, kg/year			2068.7403	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.1100	(273)

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

DER			12.1100	ZC1
Total Floor Area		TFA	170.8000	
Assumed number of occupants		N	2.9636	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			11.8781	ZC2
CO2 emissions from cooking, equation (L16)			1.1132	ZC3
Total CO2 emissions			25.1013	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			25.1013	ZC8

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	65.4500 (1b)	x 2.4000 (2b)	= 157.0800 (1b) - (3b)
First floor	64.4100 (1c)	x 2.6900 (2c)	= 173.2629 (1c) - (3c)
Second floor	40.9400 (1d)	x 2.3900 (2d)	= 97.8466 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	170.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	428.1895 (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) =					Air changes per hour 40.0000 / (5) = 0.0934 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3434 (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) =		0.3434 (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	0.4379	0.4293	0.4207	0.3778	0.3692	0.3262	0.3262	0.3177	0.3434	0.3692	0.3863	0.4035 (22b)
Effective ac	0.5959	0.5921	0.5885	0.5714	0.5681	0.5532	0.5532	0.5505	0.5590	0.5681	0.5746	0.5814 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			4.2500	1.0000	4.2500		(26)
TER Opening Type (Uw = 1.40)			29.2400	1.3258	38.7652		(27)
TER Room Window (Uw = 1.70)			0.9000	1.5918	1.4326		(27a)
150mm EPS B&B			51.3600	0.1300	6.6768		(28a)
140mm Timber Frame	193.8600	29.9000	163.9600	0.1800	29.5128		(29a)
W2V	14.8500		14.8500	0.1800	2.6730		(29a)
Dormer Cheek	11.9700	3.5900	8.3800	0.1800	1.5084		(29a)
400mm Mineral Wool	14.7000		14.7000	0.1300	1.9110		(30)
Bay Flat	1.0500		1.0500	0.1300	0.1365		(30)
Sloping	23.4900	0.9000	22.5900	0.1300	2.9367		(30)
Dormer Roof	8.5000		8.5000	0.1300	1.1050		(30)
C2V	23.4700		23.4700	0.1300	3.0511		(30)
Total net area of external elements Aum(A, m ²)			343.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.9590		(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)							17.4975 (36)
Total fabric heat loss						(33) + (36) =	111.4565 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 84.1964	Feb 83.6704	Mar 83.1549	Apr 80.7333	May 80.2802	Jun 78.1711	Jul 78.1711	Aug 77.7806	Sep 78.9835	Oct 80.2802	Nov 81.1968	Dec 82.1550 (38)
Heat transfer coeff	195.6529	195.1269	194.6114	192.1898	191.7368	189.6277	189.6277	189.2371	190.4401	191.7368	192.6533	193.6115 (39)
Average = Sum(39)m / 12 =												192.1877 (39)
HLP	Jan 1.1455	Feb 1.1424	Mar 1.1394	Apr 1.1252	May 1.1226	Jun 1.1102	Jul 1.1102	Aug 1.1079	Sep 1.1150	Oct 1.1226	Nov 1.1279	Dec 1.1336 (40)
HLP (average)												1.1252 (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												2.9636 (42)
Average daily hot water use (litres/day)												104.5865 (43)
Daily hot water use	Jan 115.0452	Feb 110.8617	Mar 106.6783	Apr 102.4948	May 98.3113	Jun 94.1279	Jul 94.1279	Aug 98.3113	Sep 102.4948	Oct 106.6783	Nov 110.8617	Dec 115.0452 (44)

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Energy conte	170.6087	149.2154	153.9770	134.2409	128.8073	111.1509	102.9976	118.1913	119.6029	139.3856	152.1503	165.2254 (45)
Energy content (annual)										Total =	Sum (45)m =	1645.5533 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.5913	22.3823	23.0965	20.1361	19.3211	16.6726	15.4496	17.7287	17.9404	20.9078	22.8225	24.7838 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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												
	219.8513	193.6927	203.2196	181.8950	178.0500	158.8051	152.2403	167.4340	167.2571	188.6283	199.8045	214.4681 (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												
	219.8513	193.6927	203.2196	181.8950	178.0500	158.8051	152.2403	167.4340	167.2571	188.6283	199.8045	214.4681 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum (64)m =			2225.3460 (64)
	96.1215	85.1959	90.5915	82.7584	82.2226	75.0810	73.6409	78.6927	77.8913	85.7399	88.7133	94.3316 (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	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	31.2436	27.7503	22.5680	17.0855	12.7716	10.7823	11.6507	15.1440	20.3262	25.8088	30.1227	32.1119 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	342.3647	345.9174	336.9648	317.9057	293.8470	271.2353	256.1292	252.5766	261.5292	280.5883	304.6469	327.2587 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182 (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)												
	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457 (71)
Water heating gains (Table 5)												
	129.1956	126.7797	121.7627	114.9423	110.5142	104.2792	98.9796	105.7698	108.1824	115.2417	123.2130	126.7898 (72)
Total internal gains												
	573.2585	570.9020	551.7502	520.3881	487.5874	456.7514	437.2142	443.9450	460.4924	492.0934	528.4372	556.6150 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	4.0200	10.6334	0.6300	0.7000	0.7700	13.0638 (74)
East	12.3100	19.6403	0.6300	0.7000	0.7700	73.8886 (76)
West	12.9100	19.6403	0.6300	0.7000	0.7700	77.4899 (80)
East	0.9000	26.0000	0.6300	0.7000	1.0000	9.2875 (82)

Solar gains	173.7298	340.3834	564.3962	832.9774	1032.0462	1062.0173	1008.7714	858.5896	659.2786	404.6755	216.6550	142.8784 (83)
Total gains	746.9883	911.2854	1116.1464	1353.3655	1519.6336	1518.7688	1445.9856	1302.5346	1119.7710	896.7690	745.0922	699.4934 (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	60.6232	60.7866	60.9477	61.7156	61.8614	62.5495	62.5495	62.6786	62.2826	61.8614	61.5671	61.2624
alpha	5.0415	5.0524	5.0632	5.1144	5.1241	5.1700	5.1700	5.1786	5.1522	5.1241	5.1045	5.0842
util living area												
	0.9995	0.9986	0.9945	0.9728	0.8957	0.7319	0.5623	0.6383	0.8965	0.9908	0.9989	0.9997 (86)
MIT	19.6128	19.7713	20.0569	20.4427	20.7668	20.9435	20.9882	20.9784	20.8283	20.3890	19.9325	19.5918 (87)
Th 2	19.9638	19.9663	19.9688	19.9803	19.9824	19.9925	19.9925	19.9943	19.9886	19.9824	19.9781	19.9735 (88)
util rest of house												
	0.9994	0.9981	0.9923	0.9617	0.8546	0.6421	0.4411	0.5134	0.8381	0.9856	0.9985	0.9996 (89)
MIT 2	18.0954	18.3290	18.7475	19.3105	19.7482	19.9541	19.9881	19.9851	19.8403	19.2418	18.5735	18.0714 (90)
Living area fraction												
MIT	18.2488	18.4748	18.8799	19.4250	19.8512	20.0541	20.0892	20.0855	19.9402	19.3578	18.7109	18.2252 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2488	18.4748	18.8799	19.4250	19.8512	20.0541	20.0892	20.0855	19.9402	19.3578	18.7109	18.2252 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9989	0.9970	0.9890	0.9537	0.8482	0.6481	0.4532	0.5254	0.8346	0.9809	0.9976	0.9992 (94)
Ext temp.	746.1982	908.5569	1103.8534	1290.6431	1288.9829	984.3237	655.2916	684.4035	934.5671	879.6080	743.2735	698.9677 (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	2729.1279	2648.8174	2409.2614	2022.7888	1562.8789	1034.2525	661.6459	697.4326	1112.2096	1679.1898	2236.8831	2715.4323 (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)
	1475.2996	1169.4551	971.2235	527.1449	203.7786	0.0000	0.0000	0.0000	0.0000	594.8889	1075.3989	1500.2497 (98)

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Space heating
Space heating per m2 (98) / (4) = 7517.4391 (98)
44.0131 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													8040.0418 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1475.2996	1169.4551	971.2235	527.1449	203.7786	0.0000	0.0000	0.0000	0.0000	594.8889	1075.3989	1500.2497	(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)	1577.8606	1250.7541	1038.7418	563.7913	217.9450	0.0000	0.0000	0.0000	0.0000	636.2448	1150.1592	1604.5451	(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	219.8513	193.6927	203.2196	181.8950	178.0500	158.8051	152.2403	167.4340	167.2571	188.6283	199.8045	214.4681	(64)
Efficiency of water heater (217)m	88.9531	88.8080	88.4479	87.4905	85.1745	79.8000	79.8000	79.8000	79.8000	87.6700	88.6378	89.0073	(216)
Fuel for water heating, kWh/month	247.1542	218.1028	229.7620	207.9026	209.0415	199.0039	190.7773	209.8170	209.5953	215.1572	225.4168	240.9556	(219)
Water heating fuel used												2602.6864	(219)
Annual totals kWh/year													
Space heating fuel - main system												8040.0418	(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)												551.7714	(232)
Total delivered energy for all uses												11269.4996	(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	8040.0418	0.2160	1736.6490 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2602.6864	0.2160	562.1803 (264)
Space and water heating			2298.8293 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	551.7714	0.5190	286.3693 (268)
Total CO2, kg/m2/year			2624.1236 (272)
Emissions per m2 for space and water heating			13.4592 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.6766 (272b)
Emissions per m2 for pumps and fans			0.2279 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.4592 * 1.00) + 1.6766 + 0.2279, rounded to 2 d.p.			15.3600 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	65.4500 (1b)	x 2.4000 (2b)	= 157.0800 (1b) - (3b)
First floor	64.4100 (1c)	x 2.6900 (2c)	= 173.2629 (1c) - (3c)
Second floor	40.9400 (1d)	x 2.3900 (2d)	= 97.8466 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	170.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 428.1895 (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) = 0.0934 (8)
Pressure test					Yes
Measured/design AP50					4.8500
Infiltration rate					0.3359 (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) =				0.3359 (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	0.4283	0.4199	0.4115	0.3695	0.3611	0.3191	0.3191	0.3107	0.3359	0.3611	0.3779	0.3947 (22b)
Effective ac	0.5917	0.5882	0.5847	0.5683	0.5652	0.5509	0.5509	0.5483	0.5564	0.5652	0.5714	0.5779 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			4.2500	1.3000	5.5250		(26)
Window (Uw = 1.40)			24.0200	1.3258	31.8447		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
Roof Window (Uw = 1.80)			0.9000	1.6791	1.5112		(27a)
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000 (28a)
140mm Timber Frame	193.8600	29.9000	163.9600	0.1900	31.1524	9.0000	1475.6400 (29a)
W2V	14.8500		14.8500	0.1400	2.0790	18.0000	267.3000 (29a)
Dormer Cheek	11.9700	3.5900	8.3800	0.3200	2.6816	18.0000	150.8400 (29a)
400mm Mineral Wool	14.7000		14.7000	0.1100	1.6170	9.0000	132.3000 (30)
Bay Flat	1.0500		1.0500	0.2500	0.2625	9.0000	9.4500 (30)
Sloping	23.4900	0.9000	22.5900	0.2000	4.5180	9.0000	203.3100 (30)
Dormer Roof	8.5000		8.5000	0.2800	2.3800	9.0000	76.5000 (30)
C2V	23.4700		23.4700	0.1400	3.2858	9.0000	211.2300 (30)
Total net area of external elements Aum(A, m ²)			343.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	103.0224			(33)
Timber GF			114.3800			9.0000	1029.4200 (32c)
Timber PF			133.7300			9.0000	1203.5700 (32c)
Timber 2F			56.7900			9.0000	511.1100 (32c)
Internal Floor			64.4100			18.0000	1159.3800 (32d)
Internal Floor 2			40.9400			18.0000	736.9200 (32d)
Internal Ceiling			64.4100			9.0000	579.6900 (32e)
Internal Ceiling 2			40.9400			9.0000	368.4600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11967.1200 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m²K 70.0651 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.9013 (36)
Total fabric heat loss (33) + (36) = 124.9237 (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	83.6112	83.1080	82.6147	80.2977	79.8642	77.8463	77.8463	77.4726	78.6236	79.8642	80.7412	81.6580 (38)
Heat transfer coeff	208.5349	208.0317	207.5384	205.2214	204.7880	202.7700	202.7700	202.3963	203.5473	204.7880	205.6649	206.5817 (39)
Average = Sum(39)m / 12 =												205.2194 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2209	1.2180	1.2151	1.2015	1.1990	1.1872	1.1872	1.1850	1.1917	1.1990	1.2041	1.2095 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9636 (42)											
Average daily hot water use (litres/day)	104.5865 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.0452	110.8617	106.6783	102.4948	98.3113	94.1279	94.1279	98.3113	102.4948	106.6783	110.8617	115.0452 (44)
Energy content	170.6087	149.2154	153.9770	134.2409	128.8073	111.1509	102.9976	118.1913	119.6029	139.3856	152.1503	165.2254 (45)
Energy content (annual)	Total = Sum(45)m =											1645.5533 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
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	36.2543	31.7083	32.7201	28.5262	27.3715	23.6196	21.8870	25.1157	25.4156	29.6194	32.3319	35.1104 (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	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.2436	27.7503	22.5680	17.0855	12.7716	10.7823	11.6507	15.1440	20.3262	25.8088	30.1227	32.1119 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	342.3647	345.9174	336.9648	317.9057	293.8470	271.2353	256.1292	252.5766	261.5292	280.5883	304.6469	327.2587 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182 (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)	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457 (71)
Water heating gains (Table 5)	48.7290	47.1849	43.9786	39.6197	36.7897	32.8050	29.4180	33.7576	35.2995	39.8111	44.9055	47.1914 (72)
Total internal gains	489.7919	488.3072	470.9661	442.0655	410.8630	382.2772	364.6525	368.9328	384.6095	413.6628	447.1297	474.0166 (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					4.0200	10.6334	0.7200	0.7000	0.7700	14.9301 (74)		
East					7.0900	19.6403	0.7200	0.7000	0.7700	48.6359 (76)		
West					12.9100	19.6403	0.7200	0.7000	0.7700	88.5599 (80)		
East					5.2200	19.6403	0.7200	0.7000	0.7700	35.8081 (76)		
East					0.9000	26.0000	0.6300	0.7000	1.0000	9.2875 (82)		

Solar gains	197.2215	386.2540	640.1254	944.3197	1169.6836	1203.5281	1143.2369	973.2336	747.5928	459.1183	245.9217	162.2179 (83)
Total gains	687.0134	874.5612	1111.0915	1386.3852	1580.5466	1585.8053	1507.8895	1342.1664	1132.2023	872.7811	693.0515	636.2346 (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	15.9407	15.9793	16.0173	16.1981	16.2324	16.3939	16.3939	16.4242	16.3313	16.2324	16.1632	16.0915
alpha	2.0627	2.0653	2.0678	2.0799	2.0822	2.0929	2.0929	2.0949	2.0888	2.0822	2.0775	2.0728
util living area	0.9716	0.9531	0.9157	0.8424	0.7361	0.6069	0.4913	0.5479	0.7457	0.9016	0.9596	0.9756 (86)
MIT	17.5133	17.8802	18.5269	19.3578	20.0737	20.5788	20.8099	20.7541	20.2978	19.3216	18.2640	17.4535 (87)
Th 2	19.9033	19.9056	19.9079	19.9188	19.9208	19.9303	19.9303	19.9320	19.9266	19.9208	19.9167	19.9124 (88)
util rest of house	0.9678	0.9469	0.9043	0.8203	0.6966	0.5415	0.3976	0.4551	0.6918	0.8831	0.9533	0.9724 (89)
MIT 2	16.6967	17.0615	17.7005	18.5154	19.1928	19.6512	19.8352	19.8012	19.4217	18.4984	17.4532	16.6430 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	16.7792	17.1443	17.7841	18.6006	19.2819	19.7450	19.9337	19.8975	19.5103	18.5817	17.5351	16.7249 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.7792	17.1443	17.7841	18.6006	19.2819	19.7450	19.9337	19.8975	19.5103	18.5817	17.5351	16.7249 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9520	0.9250	0.8748	0.7871	0.6695	0.5288	0.3980	0.4517	0.6668	0.8525	0.9333	0.9583 (94)
Useful gains	654.0388	808.9490	972.0083	1091.2224	1058.2123	838.6414	600.0692	606.2838	754.9852	744.0212	646.7968	609.6832 (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	2602.3572	2547.1940	2341.8805	1990.7690	1552.6718	1043.2586	675.9824	707.8843	1101.2565	1634.5516	2146.1441	2587.4238 (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	1449.5489	1168.1007	1019.1850	647.6736	367.8778	0.0000	0.0000	0.0000	0.0000	662.5546	1079.5300	1471.4390 (98)
Space heating	7865.9097 (98)											

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Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space heating per m2

(98) / (4) = 46.0533 (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	1906.0377	1500.4978	1538.2117	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6885	0.7493	0.7085	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1312.3125	1124.3550	1089.7831	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1974.2674	1880.6982	1691.6932	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	476.6075	562.7194	447.8211	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction												1487.1479	(104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000	(105)
	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	119.1519	140.6798	111.9553	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												371.7870	(107)
Space cooling per m2												2.1767	(108)
Energy for space heating												46.0533	(99)
Energy for space cooling												2.1767	(108)
Total												48.2301	(109)
Dwelling Fabric Energy Efficiency (DFEE)												48.2	(109)

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	65.4500 (1b)	x 2.4000 (2b)	= 157.0800 (1b) - (3b)
First floor	64.4100 (1c)	x 2.6900 (2c)	= 173.2629 (1c) - (3c)
Second floor	40.9400 (1d)	x 2.3900 (2d)	= 97.8466 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	170.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 428.1895 (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) = 0.0934 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3434 (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) =				0.3434 (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	0.4379	0.4293	0.4207	0.3778	0.3692	0.3262	0.3262	0.3177	0.3434	0.3692	0.3863	0.4035 (22b)
Effective ac	0.5959	0.5921	0.5885	0.5714	0.5681	0.5532	0.5532	0.5505	0.5590	0.5681	0.5746	0.5814 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			4.2500	1.0000	4.2500		(26)
TER Opening Type (Uw = 1.40)			29.2400	1.3258	38.7652		(27)
TER Room Window (Uw = 1.70)			0.9000	1.5918	1.4326		(27a)
150mm EPS B&B			51.3600	0.1300	6.6768		(28a)
140mm Timber Frame	193.8600	29.9000	163.9600	0.1800	29.5128		(29a)
W2V	14.8500		14.8500	0.1800	2.6730		(29a)
Dormer Cheek	11.9700	3.5900	8.3800	0.1800	1.5084		(29a)
400mm Mineral Wool	14.7000		14.7000	0.1300	1.9110		(30)
Bay Flat	1.0500		1.0500	0.1300	0.1365		(30)
Sloping	23.4900	0.9000	22.5900	0.1300	2.9367		(30)
Dormer Roof	8.5000		8.5000	0.1300	1.1050		(30)
C2V	23.4700		23.4700	0.1300	3.0511		(30)
Total net area of external elements Aum(A, m ²)			343.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	93.9590		(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)							17.4975 (36)
Total fabric heat loss						(33) + (36) =	111.4565 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 84.1964	Feb 83.6704	Mar 83.1549	Apr 80.7333	May 80.2802	Jun 78.1711	Jul 78.1711	Aug 77.7806	Sep 78.9835	Oct 80.2802	Nov 81.1968	Dec 82.1550 (38)
Heat transfer coeff	195.6529	195.1269	194.6114	192.1898	191.7368	189.6277	189.6277	189.2371	190.4401	191.7368	192.6533	193.6115 (39)
Average = Sum(39)m / 12 =												192.1877 (39)
HLP	Jan 1.1455	Feb 1.1424	Mar 1.1394	Apr 1.1252	May 1.1226	Jun 1.1102	Jul 1.1102	Aug 1.1079	Sep 1.1150	Oct 1.1226	Nov 1.1279	Dec 1.1336 (40)
HLP (average)												1.1252 (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												2.9636 (42)
Average daily hot water use (litres/day)												104.5865 (43)
Daily hot water use	Jan 115.0452	Feb 110.8617	Mar 106.6783	Apr 102.4948	May 98.3113	Jun 94.1279	Jul 94.1279	Aug 98.3113	Sep 102.4948	Oct 106.6783	Nov 110.8617	Dec 115.0452 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	170.6087	149.2154	153.9770	134.2409	128.8073	111.1509	102.9976	118.1913	119.6029	139.3856	152.1503	165.2254 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1645.5533 (45)
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	36.2543	31.7083	32.7201	28.5262	27.3715	23.6196	21.8870	25.1157	25.4156	29.6194	32.3319	35.1104 (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	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822	148.1822 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.2436	27.7503	22.5680	17.0855	12.7716	10.7823	11.6507	15.1440	20.3262	25.8088	30.1227	32.1119 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	342.3647	345.9174	336.9648	317.9057	293.8470	271.2353	256.1292	252.5766	261.5292	280.5883	304.6469	327.2587 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182	37.8182 (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)	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457 (71)
Water heating gains (Table 5)	48.7290	47.1849	43.9786	39.6197	36.7897	32.8050	29.4180	33.7576	35.2995	39.8111	44.9055	47.1914 (72)
Total internal gains	489.7919	488.3072	470.9661	442.0655	410.8630	382.2772	364.6525	368.9328	384.6095	413.6628	447.1297	474.0166 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W		
North				4.0200	10.6334	0.6300	0.7000	0.7700		13.0638 (74)		
East				12.3100	19.6403	0.6300	0.7000	0.7700		73.8886 (76)		
West				12.9100	19.6403	0.6300	0.7000	0.7700		77.4899 (80)		
East				0.9000	26.0000	0.6300	0.7000	1.0000		9.2875 (82)		
Solar gains	173.7298	340.3834	564.3962	832.9774	1032.0462	1062.0173	1008.7714	858.5896	659.2786	404.6755	216.6550	142.8784 (83)
Total gains	663.5217	828.6907	1035.3623	1275.0429	1442.9092	1444.2945	1373.4240	1227.5224	1043.8881	818.3383	663.7847	616.8950 (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	60.6232	60.7866	60.9477	61.7156	61.8614	62.5495	62.5495	62.6786	62.2826	61.8614	61.5671	61.2624
alpha	5.0415	5.0524	5.0632	5.1144	5.1241	5.1700	5.1700	5.1786	5.1522	5.1241	5.1045	5.0842
util living area	0.9997	0.9991	0.9960	0.9786	0.9112	0.7574	0.5885	0.6696	0.9171	0.9938	0.9994	0.9998 (86)
MIT	19.5670	19.7261	20.0135	20.4047	20.7412	20.9337	20.9855	20.9731	20.8026	20.3475	19.8878	19.5463 (87)
Th 2	19.9638	19.9663	19.9688	19.9803	19.9824	19.9925	19.9925	19.9943	19.9886	19.9824	19.9781	19.9735 (88)
util rest of house	0.9997	0.9988	0.9945	0.9696	0.8740	0.6686	0.4634	0.5422	0.8659	0.9903	0.9991	0.9998 (89)
MIT 2	18.6423	18.8033	19.0920	19.4869	19.8018	19.9610	19.9887	19.9862	19.8682	19.4361	18.9745	18.6294 (90)
Living area fraction									fLA = Living area / (4) =			0.1011 (91)
MIT	18.7358	18.8966	19.1852	19.5797	19.8968	20.0594	20.0895	20.0860	19.9627	19.5283	19.0669	18.7221 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7358	18.8966	19.1852	19.5797	19.8968	20.0594	20.0895	20.0860	19.9627	19.5283	19.0669	18.7221 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9995	0.9983	0.9928	0.9649	0.8703	0.6751	0.4760	0.5547	0.8643	0.9880	0.9988	0.9997 (94)
Useful gains	663.1796	827.2950	1027.9405	1230.2960	1255.7075	975.1154	653.7535	680.8958	902.1834	808.5016	662.9632	616.6795 (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	2824.4115	2731.1228	2468.6757	2052.5246	1571.6223	1035.2440	661.7038	697.5325	1116.4961	1711.8803	2305.4549	2811.6451 (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	1607.9565	1279.3723	1071.9070	592.0045	235.0407	0.0000	0.0000	0.0000	0.0000	672.1137	1182.5941	1633.0544 (98)
Space heating												8274.0433 (98)
Space heating per m2										(98) / (4) =		48.4429 (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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1782.5000	1403.2447	1438.2019	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8440	0.9107	0.8697	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1504.4527	1277.9080	1250.7434	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1808.8652	1723.5307	1557.6938	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	219.1770	331.5433	228.3711	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												779.0913	(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	54.7942	82.8858	57.0928	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												194.7728	(107)
Space cooling per m2												1.1404	(108)
Energy for space heating												48.4429	(99)
Energy for space cooling												1.1404	(108)
Total												49.5832	(109)
Target Fabric Energy Efficiency (TFEE)												57.0	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	65.4500 (1b)	x 2.4000 (2b)	= 157.0800 (1b) - (3b)
First floor	64.4100 (1c)	x 2.6900 (2c)	= 173.2629 (1c) - (3c)
Second floor	40.9400 (1d)	x 2.3900 (2d)	= 97.8466 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	170.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 428.1895 (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											0 * 10 =	0.0000 (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) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate													4.8500
Number of sides sheltered													0.2425 (18)
													0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.2425 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)	
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)	
Adj infilt rate													
	0.2668	0.2486	0.2486	0.2364	0.2364	0.2243	0.2243	0.2122	0.2122	0.2304	0.2243	0.2364 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5168	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			4.2500	1.3000	5.5250		(26)					
Window (Uw = 1.40)			24.0200	1.3258	31.8447		(27)					
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)					
Roof Window (Uw = 1.80)			0.9000	1.6791	1.5112		(27a)					
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000 (28a)					
140mm Timber Frame	193.8600	29.9000	163.9600	0.1900	31.1524	9.0000	1475.6400 (29a)					
W2V	14.8500		14.8500	0.1400	2.0790	18.0000	267.3000 (29a)					
Dormer Cheek	11.9700	3.5900	8.3800	0.3200	2.6816	18.0000	150.8400 (29a)					
400mm Mineral Wool	14.7000		14.7000	0.1100	1.6170	9.0000	132.3000 (30)					
Bay Flat	1.0500		1.0500	0.2500	0.2625	9.0000	9.4500 (30)					
Sloping	23.4900	0.9000	22.5900	0.2000	4.5180	9.0000	203.3100 (30)					
Dormer Roof	8.5000		8.5000	0.2800	2.3800	9.0000	76.5000 (30)					
C2V	23.4700		23.4700	0.1400	3.2858	9.0000	211.2300 (30)					
Total net area of external elements Aum(A, m2)			343.2500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	103.0224		(33)					
Timber GF			114.3800			9.0000	1029.4200 (32c)					
Timber FF			133.7300			9.0000	1203.5700 (32c)					
Timber 2F			56.7900			9.0000	511.1100 (32c)					
Internal Floor			64.4100			18.0000	1159.3800 (32d)					
Internal Floor 2			40.9400			18.0000	736.9200 (32d)					
Internal Ceiling			64.4100			18.0000	1159.3800 (32e)					
Internal Ceiling 2			40.9400			18.0000	736.9200 (32e)					
Heat capacity Cm = Sum(A x k)					(28) ... (30) + (32) + (32a) ... (32e) =		12915.2700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							75.6163 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.9013 (36)					
Total fabric heat loss						(33) + (36) =	124.9237 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 73.0181	Feb 70.6513	Mar 70.6513	Apr 70.6513	May 70.6513	Jun 70.6513	Jul 70.6513	Aug 70.6513	Sep 70.6513	Oct 70.6513	Nov 70.6513	Dec 70.6513 (38)
Heat transfer coeff	197.9418	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750 (39)
Average = Sum(39)m / 12 =												195.7722 (39)
HLP	Jan 1.1589	Feb 1.1451	Mar 1.1451	Apr 1.1451	May 1.1451	Jun 1.1451	Jul 1.1451	Aug 1.1451	Sep 1.1451	Oct 1.1451	Nov 1.1451	Dec 1.1451 (40)
HLP (average)												1.1462 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9636 (42)											
Average daily hot water use (litres/day)	104.5865 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.0452	110.8617	106.6783	102.4948	98.3113	94.1279	94.1279	98.3113	102.4948	106.6783	110.8617	115.0452 (44)
Energy content (annual)	170.6087	149.2154	153.9770	134.2409	128.8073	111.1509	102.9976	118.1913	119.6029	139.3856	152.1503	165.2254 (45)
Distribution loss (46)m = 0.15 x (45)m	25.5913											
Water storage loss:	22.3823	23.0965	20.1361	19.3211	16.6726	15.4496	17.7287	17.9404	20.9078	22.8225	24.7838	24.7838 (46)
Store volume	180.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.4000 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.7560 (55)											
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (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	217.3071	191.3946	200.6754	179.4329	175.5057	156.3429	149.6960	164.8897	164.7949	186.0840	197.3423	211.9238 (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	217.3071	191.3946	200.6754	179.4329	175.5057	156.3429	149.6960	164.8897	164.7949	186.0840	197.3423	211.9238 (64)
RHI water heating demand	2195.3893 (64)											
Heat gains from water heating, kWh/month	94.0861	83.3575	88.5561	80.7887	80.1871	73.1113	71.6054	76.6573	75.9216	83.7044	86.7436	92.2962 (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	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.1089	69.3757	56.4201	42.7136	31.9289	26.9558	29.1267	37.8599	50.8155	64.5220	75.3067	80.2798 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	510.9921	516.2946	502.9325	474.4861	438.5776	404.8288	382.2824	376.9799	390.3421	418.7884	454.6969	488.4458 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455 (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)	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457 (71)
Water heating gains (Table 5)	126.4598	124.0439	119.0270	112.2065	107.7784	101.5434	96.2439	103.0340	105.4466	112.5060	120.4772	124.0540 (72)
Total internal gains	833.5792	827.7325	796.3979	747.4246	696.3034	651.3463	625.6713	635.8923	664.6225	713.8347	768.4991	810.7980 (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					4.0200	13.4839	0.7200	0.7000				0.7700			18.9324 (74)
East					7.0900	25.1925	0.7200	0.7000				0.7700			62.3853 (76)
West					12.9100	25.1925	0.7200	0.7000				0.7700			113.5957 (80)
East					5.2200	25.1925	0.7200	0.7000				0.7700			45.9310 (76)
East					0.9000	34.0000	0.6300	0.7000				1.0000			12.1451 (82)
Solar gains	252.9895	421.8457	703.6527	1040.7525	1215.4800	1369.5058	1255.7362	1118.1963	860.4245	533.9724	314.5075	196.9141			(83)
Total gains	1086.5688	1249.5783	1500.0506	1788.1771	1911.7834	2020.8521	1881.4075	1754.0885	1525.0471	1247.8071	1083.0066	1007.7120			(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	18.1244	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437
alpha	2.2083	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229
util living area	0.9331	0.9090	0.8517	0.7507	0.6137	0.4356	0.3215	0.3417	0.5769	0.7978	0.9030	0.9406 (86)
MIT	18.4668	18.7679	19.3504	20.0064	20.5434	20.8561	20.9501	20.9435	20.7113	20.0608	19.1745	18.4408 (87)
Th 2	19.9530	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642 (88)
util rest of house	0.9244	0.8975	0.8328	0.7188	0.5621	0.3618	0.2281	0.2435	0.5034	0.7621	0.8882	0.9327 (89)
MIT 2	16.6017	17.0369	17.8638	18.7722	19.4828	19.8497	19.9396	19.9360	19.7045	18.8742	17.6287	16.5700 (90)
Living area fraction	16.7903	17.2119	18.0141	18.8970	19.5900	19.9514	20.0417	20.0379	19.8063	18.9941	17.7850	16.7592 (92)
MIT	16.6403	17.0619	17.8641	18.7470	19.4400	19.8014	19.8917	19.8879	19.6563	18.8441	17.6350	16.6092 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8832	0.8517	0.7828	0.6743	0.5329	0.3494	0.2212	0.2358	0.4789	0.7136	0.8410	0.8939	(94)
Useful gains	959.6324	1064.2949	1174.2719	1205.7923	1018.7070	706.0625	416.1889	413.6826	730.2738	890.3864	910.7683	900.7827	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	2224.9161	2182.9924	2007.4001	1710.6968	1239.9497	763.0229	428.6503	427.8893	851.9821	1338.5421	1806.1352	2172.6777	(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	941.3711	751.7648	619.8474	363.5312	164.6046	0.0000	0.0000	0.0000	0.0000	333.4278	644.6642	946.2899	(98)
Space heating												4765.5009	(98)
RHI space heating demand												4766	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	65.4500 (1b)	x 2.4000 (2b)	= 157.0800 (1b) - (3b)
First floor	64.4100 (1c)	x 2.6900 (2c)	= 173.2629 (1c) - (3c)
Second floor	40.9400 (1d)	x 2.3900 (2d)	= 97.8466 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	170.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 428.1895 (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							0 * 10 =	0.0000 (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) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							4.8500					
Infiltration rate							0.2425	(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) =	0.2425 (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)
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												
	0.3092	0.3031	0.2971	0.2668	0.2607	0.2304	0.2304	0.2243	0.2425	0.2607	0.2728	0.2849 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5592	0.5531	0.5471	0.5168	0.5107	0.5000	0.5000	0.5000	0.5000	0.5107	0.5228	0.5349 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid Door			4.2500	1.3000	5.5250			(26)					
Window (Uw = 1.40)			24.0200	1.3258	31.8447			(27)					
French Door (Uw = 1.40)			5.2200	1.3258	6.9205			(27)					
Roof Window (Uw = 1.80)			0.9000	1.6791	1.5112			(27a)					
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000	(28a)					
140mm Timber Frame	193.8600	29.9000	163.9600	0.1900	31.1524	9.0000	1475.6400	(29a)					
W2V	14.8500		14.8500	0.1400	2.0790	18.0000	267.3000	(29a)					
Dormer Cheek	11.9700	3.5900	8.3800	0.3200	2.6816	18.0000	150.8400	(29a)					
400mm Mineral Wool	14.7000		14.7000	0.1100	1.6170	9.0000	132.3000	(30)					
Bay Flat	1.0500		1.0500	0.2500	0.2625	9.0000	9.4500	(30)					
Sloping	23.4900	0.9000	22.5900	0.2000	4.5180	9.0000	203.3100	(30)					
Dormer Roof	8.5000		8.5000	0.2800	2.3800	9.0000	76.5000	(30)					
C2V	23.4700		23.4700	0.1400	3.2858	9.0000	211.2300	(30)					
Total net area of external elements Aum(A, m2)			343.2500					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	103.0224			(33)					
Timber GF			114.3800			9.0000	1029.4200	(32c)					
Timber FF			133.7300			9.0000	1203.5700	(32c)					
Timber 2F			56.7900			9.0000	511.1100	(32c)					
Internal Floor			64.4100			18.0000	1159.3800	(32d)					
Internal Floor 2			40.9400			18.0000	736.9200	(32d)					
Internal Ceiling			64.4100			18.0000	1159.3800	(32e)					
Internal Ceiling 2			40.9400			18.0000	736.9200	(32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			12915.2700	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							75.6163	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.9013	(36)					
Total fabric heat loss				(33) + (36) =			124.9237	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	79.0146	78.1580	77.3013	73.0181	72.1614	70.6513	70.6513	70.6513	70.6513	72.1614	73.8747	75.5880	(38)
Average = Sum(39)m / 12 =	203.9383	203.0817	202.2250	197.9418	197.0852	195.5750	195.5750	195.5750	195.5750	197.0852	198.7984	200.5117	(39)
												198.5806	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1940	1.1890	1.1840	1.1589	1.1539	1.1451	1.1451	1.1451	1.1451	1.1539	1.1639	1.1740	(40)
Days in month												1.1626	(40)
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9636 (42)											
Average daily hot water use (litres/day)	104.5865 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.0452	110.8617	106.6783	102.4948	98.3113	94.1279	94.1279	98.3113	102.4948	106.6783	110.8617	115.0452 (44)
Energy content (annual)	170.6087	149.2154	153.9770	134.2409	128.8073	111.1509	102.9976	118.1913	119.6029	139.3856	152.1503	165.2254 (45)
Distribution loss (46)m = 0.15 x (45)m	25.5913											
Water storage loss:	23.3823	22.3823	23.0965	20.1361	19.3211	16.6726	15.4496	17.7287	17.9404	20.9078	22.8225	24.7838 (46)
Store volume	180.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.4000 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.7560 (55)											
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (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	217.3071	191.3946	200.6754	179.4329	175.5057	156.3429	149.6960	164.8897	164.7949	186.0840	197.3423	211.9238 (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	217.3071	191.3946	200.6754	179.4329	175.5057	156.3429	149.6960	164.8897	164.7949	186.0840	197.3423	211.9238 (64)
Heat gains from water heating, kWh/month	94.0861	83.3575	88.5561	80.7887	80.1871	73.1113	71.6054	76.6573	75.9216	83.7044	86.7436	92.2962 (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	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.1089	69.3757	56.4201	42.7136	31.9289	26.9558	29.1267	37.8599	50.8155	64.5220	75.3067	80.2798 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	510.9921	516.2946	502.9325	474.4861	438.5776	404.8288	382.2824	376.9799	390.3421	418.7884	454.6969	488.4458 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455 (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)	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457 (71)
Water heating gains (Table 5)	126.4598	124.0439	119.0270	112.2065	107.7784	101.5434	96.2439	103.0340	105.4466	112.5060	120.4772	124.0540 (72)
Total internal gains	833.5792	827.7325	796.3979	747.4246	696.3034	651.3463	625.6713	635.8923	664.6225	713.8347	768.4991	810.7980 (73)

6. Solar gains

[Jan]			Area		Solar flux		g		FF		Access		Gains
			m2		Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
North			4.0200		10.6334		0.7200		0.7000		0.7700		14.9301 (74)
East			7.0900		19.6403		0.7200		0.7000		0.7700		48.6359 (76)
West			12.9100		19.6403		0.7200		0.7000		0.7700		88.5599 (80)
East			5.2200		19.6403		0.7200		0.7000		0.7700		35.8081 (76)
East			0.9000		26.0000		0.6300		0.7000		1.0000		9.2875 (82)
Solar gains	197.2215	386.2540	640.1254	944.3197	1169.6836	1203.5281	1143.2369	973.2336	747.5928	459.1183	245.9217	162.2179	(83)
Total gains	1030.8008	1213.9865	1436.5233	1691.7443	1865.9870	1854.8744	1768.9083	1609.1259	1412.2154	1172.9531	1014.4209	973.0159	(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	17.5915	17.6657	17.7405	18.1244	18.2032	18.3437	18.3437	18.3437	18.3437	18.2032	18.0463	17.8921
alpha	2.1728	2.1777	2.1827	2.2083	2.2135	2.2229	2.2229	2.2229	2.2229	2.2135	2.2031	2.1928
util living area	0.9468	0.9241	0.8802	0.7973	0.6826	0.5474	0.4307	0.4791	0.6739	0.8509	0.9275	0.9524 (86)
MIT	18.0739	18.4082	18.9833	19.7220	20.3157	20.7097	20.8787	20.8420	20.5114	19.7129	18.7786	18.0356 (87)
Th 2	19.9248	19.9288	19.9328	19.9530	19.9571	19.9642	19.9642	19.9642	19.9642	19.9571	19.9490	19.9409 (88)
util rest of house	0.9401	0.9146	0.8649	0.7713	0.6406	0.4833	0.3449	0.3922	0.6155	0.8256	0.9169	0.9464 (89)
MIT 2	16.0233	16.5049	17.3283	18.3756	19.1836	19.6898	19.8783	19.8456	19.4653	18.3894	17.0540	15.9738 (90)
Living area fraction	16.2307	16.6974	17.4956	18.5118	19.2981	19.7929	19.9794	19.9464	19.5711	18.5232	17.2284	16.1822 (92)
Temperature adjustment	16.0807	16.5474	17.3456	18.3618	19.1481	19.6429	19.8294	19.7964	19.4211	18.3732	17.0784	16.0322 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9025	0.8706	0.8148	0.7225	0.6031	0.4614	0.3329	0.3768	0.5798	0.7747	0.8738	0.9113	(94)
Useful gains	930.3411	1056.8637	1170.5454	1222.3415	1125.3669	855.8034	588.8982	606.3358	818.8497	908.7216	886.3579	886.7049	(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	2402.5287	2365.3717	2193.2616	1872.8832	1467.9080	986.2653	631.5935	664.2486	1040.6725	1531.9843	1983.6822	2372.5045	(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	1095.3076	879.3174	760.9009	468.3900	254.8506	0.0000	0.0000	0.0000	0.0000	463.7074	790.0735	1105.4349	(98)
Space heating												5817.9823	(98)
Space heating per m2											(98) / (4) =	34.0631	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													6435.8211	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1095.3076	879.3174	760.9009	468.3900	254.8506	0.0000	0.0000	0.0000	0.0000	463.7074	790.0735	1105.4349	(98)	
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)	
Space heating fuel (main heating system)	1211.6234	972.6962	841.7045	518.1306	281.9144	0.0000	0.0000	0.0000	0.0000	512.9507	873.9751	1222.8262	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	217.3071	191.3946	200.6754	179.4329	175.5057	156.3429	149.6960	164.8897	164.7949	186.0840	197.3423	211.9238	(64)	
Efficiency of water heater	88.4345	88.2814	87.9362	87.1590	85.7075	79.7000	79.7000	79.7000	79.7000	87.0531	88.0378	88.4889	(217)	
Fuel for water heating, kWh/month	245.7267	216.8007	228.2056	205.8685	204.7729	196.1642	187.8244	206.8880	206.7690	213.7593	224.1563	239.4920	(219)	
Water heating fuel used												2576.4276	(219)	
Annual totals kWh/year														
Space heating fuel - main system												6435.8211	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)														
mechanical ventilation fans (SFP = 0.2308)													120.5738	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													195.5738	(231)
Electricity for lighting (calculated in Appendix L)													551.7714	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.96 * 1004 * 1.00) =										-771.0691		-771.0691	(233)	
Total delivered energy for all uses												8988.5248	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6435.8211	3.4800	223.9666	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2576.4276	3.4800	89.6597	(247)
Mechanical ventilation fans	120.5738	13.1900	15.9037	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	551.7714	13.1900	72.7786	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-771.0691	13.1900	-101.7040	(252)
Total energy cost			430.4971	(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] =	0.8379	(257)
SAP value			88.3119	
SAP rating (Section 12)			88	(258)
SAP band			B	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6435.8211	0.2160	1390.1374 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2576.4276	0.2160	556.5084 (264)
Space and water heating			1946.6457 (265)
Pumps and fans	195.5738	0.5190	101.5028 (267)
Energy for lighting	551.7714	0.5190	286.3693 (268)
Energy saving/generation technologies			
PV Unit	-771.0691	0.5190	-400.1849 (269)
Total kg/year			1934.3330 (272)
CO2 emissions per m2			11.3300 (273)
EI value			87.9888
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8499 = 4.095$, stars = 4
Water heating environmental impact	$0.216 / 0.8499 = 0.2541$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	65.4500 (1b)	x 2.4000 (2b)	= 157.0800 (1b) - (3b)
First floor	64.4100 (1c)	x 2.6900 (2c)	= 173.2629 (1c) - (3c)
Second floor	40.9400 (1d)	x 2.3900 (2d)	= 97.8466 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	170.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 428.1895 (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					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.8500
Infiltration rate					0.2425 (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) =		0.2425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.2668	0.2486	0.2486	0.2364	0.2364	0.2243	0.2243	0.2122	0.2122	0.2304	0.2243	0.2364 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5168	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			4.2500	1.3000	5.5250		(26)
Window (Uw = 1.40)			24.0200	1.3258	31.8447		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
Roof Window (Uw = 1.80)			0.9000	1.6791	1.5112		(27a)
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000 (28a)
140mm Timber Frame	193.8600	29.9000	163.9600	0.1900	31.1524	9.0000	1475.6400 (29a)
W2V	14.8500		14.8500	0.1400	2.0790	18.0000	267.3000 (29a)
Dormer Cheek	11.9700	3.5900	8.3800	0.3200	2.6816	18.0000	150.8400 (29a)
400mm Mineral Wool	14.7000		14.7000	0.1100	1.6170	9.0000	132.3000 (30)
Bay Flat	1.0500		1.0500	0.2500	0.2625	9.0000	9.4500 (30)
Sloping	23.4900	0.9000	22.5900	0.2000	4.5180	9.0000	203.3100 (30)
Dormer Roof	8.5000		8.5000	0.2800	2.3800	9.0000	76.5000 (30)
C2V	23.4700		23.4700	0.1400	3.2858	9.0000	211.2300 (30)
Total net area of external elements Aum(A, m ²)			343.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	103.0224		(33)
Timber GF			114.3800			9.0000	1029.4200 (32c)
Timber FF			133.7300			9.0000	1203.5700 (32c)
Timber 2F			56.7900			9.0000	511.1100 (32c)
Internal Floor			64.4100			18.0000	1159.3800 (32d)
Internal Floor 2			40.9400			18.0000	736.9200 (32d)
Internal Ceiling			64.4100			18.0000	1159.3800 (32e)
Internal Ceiling 2			40.9400			18.0000	736.9200 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12915.2700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		75.6163 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		21.9013 (36)
Total fabric heat loss	(33) + (36) =	124.9237 (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	73.0181	70.6513	70.6513	70.6513	70.6513	70.6513	70.6513	70.6513	70.6513	70.6513	70.6513	70.6513 (38)
Heat transfer coeff	197.9418	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750 (39)
Average = Sum(39)m / 12 =												195.7722 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1589	1.1451	1.1451	1.1451	1.1451	1.1451	1.1451	1.1451	1.1451	1.1451	1.1451	1.1451 (40)
HLP (average)												1.1462 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9636 (42)											
Average daily hot water use (litres/day)	104.5865 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.0452	110.8617	106.6783	102.4948	98.3113	94.1279	94.1279	98.3113	102.4948	106.6783	110.8617	115.0452 (44)
Energy content (annual)	170.6087	149.2154	153.9770	134.2409	128.8073	111.1509	102.9976	118.1913	119.6029	139.3856	152.1503	165.2254 (45)
Distribution loss (46)m = 0.15 x (45)m	25.5913											
Water storage loss:	23.3823	22.3823	23.0965	20.1361	19.3211	16.6726	15.4496	17.7287	17.9404	20.9078	22.8225	24.7838 (46)
Store volume	180.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.4000 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.7560 (55)											
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (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	217.3071	191.3946	200.6754	179.4329	175.5057	156.3429	149.6960	164.8897	164.7949	186.0840	197.3423	211.9238 (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	217.3071	191.3946	200.6754	179.4329	175.5057	156.3429	149.6960	164.8897	164.7949	186.0840	197.3423	211.9238 (64)
Heat gains from water heating, kWh/month	94.0861	83.3575	88.5561	80.7887	80.1871	73.1113	71.6054	76.6573	75.9216	83.7044	86.7436	92.2962 (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	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.1089	69.3757	56.4201	42.7136	31.9289	26.9558	29.1267	37.8599	50.8155	64.5220	75.3067	80.2798 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	510.9921	516.2946	502.9325	474.4861	438.5776	404.8288	382.2824	376.9799	390.3421	418.7884	454.6969	488.4458 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455 (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)	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457 (71)
Water heating gains (Table 5)	126.4598	124.0439	119.0270	112.2065	107.7784	101.5434	96.2439	103.0340	105.4466	112.5060	120.4772	124.0540 (72)
Total internal gains	833.5792	827.7325	796.3979	747.4246	696.3034	651.3463	625.6713	635.8923	664.6225	713.8347	768.4991	810.7980 (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				4.0200	13.4839		0.7200		0.7000		0.7700		18.9324 (74)
East				7.0900	25.1925		0.7200		0.7000		0.7700		62.3853 (76)
West				12.9100	25.1925		0.7200		0.7000		0.7700		113.5957 (80)
East				5.2200	25.1925		0.7200		0.7000		0.7700		45.9310 (76)
East				0.9000	34.0000		0.6300		0.7000		1.0000		12.1451 (82)
Solar gains	252.9895	421.8457	703.6527	1040.7525	1215.4800	1369.5058	1255.7362	1118.1963	860.4245	533.9724	314.5075	196.9141	(83)
Total gains	1086.5688	1249.5783	1500.0506	1788.1771	1911.7834	2020.8521	1881.4075	1754.0885	1525.0471	1247.8071	1083.0066	1007.7120	(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	18.1244	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437
alpha	2.2083	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229
util living area	0.9331	0.9090	0.8517	0.7507	0.6137	0.4356	0.3215	0.3417	0.5769	0.7978	0.9030	0.9406 (86)
MIT	18.4668	18.7679	19.3504	20.0064	20.5434	20.8561	20.9501	20.9435	20.7113	20.0608	19.1745	18.4408 (87)
Th 2	19.9530	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642 (88)
util rest of house	0.9244	0.8975	0.8328	0.7188	0.5621	0.3618	0.2281	0.2435	0.5034	0.7621	0.8882	0.9327 (89)
MIT 2	16.6017	17.0369	17.8638	18.7722	19.4828	19.8497	19.9396	19.9360	19.7045	18.8742	17.6287	16.5700 (90)
Living area fraction	16.7903	17.2119	18.0141	18.8970	19.5900	19.9514	20.0417	20.0379	19.8063	18.9941	17.7850	16.7592 (92)
Temperature adjustment	16.6403	17.0619	17.8641	18.7470	19.4400	19.8014	19.8917	19.8879	19.6563	18.8441	17.6350	16.6092 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8832	0.8517	0.7828	0.6743	0.5329	0.3494	0.2212	0.2358	0.4789	0.7136	0.8410	0.8939	(94)
Useful gains	959.6324	1064.2949	1174.2719	1205.7923	1018.7070	706.0625	416.1889	413.6826	730.2738	890.3864	910.7683	900.7827	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W													
	2224.9161	2182.9924	2007.4001	1710.6968	1239.9497	763.0229	428.6503	427.8893	851.9821	1338.5421	1806.1352	2172.6777	(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													
	941.3711	751.7648	619.8474	363.5312	164.6046	0.0000	0.0000	0.0000	0.0000	333.4278	644.6642	946.2899	(98)
Space heating												4765.5009	(98)
Space heating per m2											(98) / (4) =	27.9011	(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)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5271.5718	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	941.3711	751.7648	619.8474	363.5312	164.6046	0.0000	0.0000	0.0000	0.0000	333.4278	644.6642	946.2899	(98)	
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)	
Space heating fuel (main heating system)	1041.3397	831.5982	685.6719	402.1363	182.0847	0.0000	0.0000	0.0000	0.0000	368.8360	713.1241	1046.7809	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	217.3071	191.3946	200.6754	179.4329	175.5057	156.3429	149.6960	164.8897	164.7949	186.0840	197.3423	211.9238	(64)	
Efficiency of water heater	88.1797	88.0025	87.5261	86.5596	84.5430	79.7000	79.7000	79.7000	79.7000	86.2523	87.6423	88.2326	(217)	
Fuel for water heating, kWh/month	246.4365	217.4878	229.2748	207.2939	207.5934	196.1642	187.8244	206.8880	206.7690	215.7439	225.1678	240.1877	(219)	
Water heating fuel used												2586.8315	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5271.5718	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)														
mechanical ventilation fans (SFP = 0.2308)													120.5738	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													195.5738	(231)
Electricity for lighting (calculated in Appendix L)													551.7714	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.96 * 1115 * 1.00) =										-856.2413		-856.2413	(233)	
Total delivered energy for all uses												7749.5071	(238)	

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5271.5718	7.6100	401.1666	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2586.8315	7.6100	196.8579	(247)
Mechanical ventilation fans	120.5738	31.0800	37.4743	(249)
Pumps and fans for heating	75.0000	31.0800	23.3100	(249)
Energy for lighting	551.7714	31.0800	171.4905	(250)
Additional standing charges			105.0000	(251)
Energy saving/generation technologies				
PV Unit	-856.2413	31.0800	-266.1198	(252)
Total energy cost			669.1796	(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	5271.5718	0.2160	1138.6595	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2586.8315	0.2160	558.7556	(264)
Space and water heating			1697.4151	(265)
Pumps and fans	195.5738	0.5190	101.5028	(267)
Energy for lighting	551.7714	0.5190	286.3693	(268)
Energy saving/generation technologies				

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

PV Unit	-856.2413	0.5190	-444.3893 (269)
Total kg/year			1640.8980 (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	5271.5718	1.2200	6431.3176 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2586.8315	1.2200	3155.9344 (264)
Space and water heating			9587.2520 (265)
Pumps and fans	195.5738	3.0700	600.4116 (267)
Energy for lighting	551.7714	3.0700	1693.9381 (268)
Energy saving/generation technologies			
PV Unit	-856.2413	3.0700	-2628.6609 (269)
Primary energy kWh/year			9252.9408 (272)
Primary energy kWh/m2/year			54.1741 (273)

SAP 2012 EPC IMPROVEMENTS

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

(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	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 89	-271 kg (16.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£89 1.59 kg/m²	B 89	B 90
Total Savings	£89 1.59 kg/m²		

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

Fuel prices for cost data on this page from database revision number 538 TEST (29 Feb 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£232	£248	-£16
Mains gas	£703	£598	£105
Space heating	£567	£569	-£2
Water heating	£197	£106	£91
Lighting	£171	£171	£0
Generated (PV)	-£266	-£266	£0
Total cost of fuels	£669	£580	£89
Total cost of uses	£669	£580	£89
Delivered energy	45 kWh/m²	38 kWh/m²	8 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Carbon dioxide emissions	1.6 tonnes	1.4 tonnes	0.3 tonnes
CO2 emissions per m ²	10 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	54 kWh/m ²	45 kWh/m ²	9 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	65.4500 (1b)	x 2.4000 (2b)	= 157.0800 (1b) - (3b)
First floor	64.4100 (1c)	x 2.6900 (2c)	= 173.2629 (1c) - (3c)
Second floor	40.9400 (1d)	x 2.3900 (2d)	= 97.8466 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	170.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 428.1895 (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					0 * 10 = 0.0000 (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) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.8500
Infiltration rate					0.2425 (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) =				0.2425 (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	0.3092	0.3031	0.2971	0.2668	0.2607	0.2304	0.2304	0.2243	0.2425	0.2607	0.2728	0.2849 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5592	0.5531	0.5471	0.5168	0.5107	0.5000	0.5000	0.5000	0.5000	0.5107	0.5228	0.5349 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			4.2500	1.3000	5.5250		(26)
Window (Uw = 1.40)			24.0200	1.3258	31.8447		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
Roof Window (Uw = 1.80)			0.9000	1.6791	1.5112		(27a)
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000 (28a)
140mm Timber Frame	193.8600	29.9000	163.9600	0.1900	31.1524	9.0000	1475.6400 (29a)
W2V	14.8500		14.8500	0.1400	2.0790	18.0000	267.3000 (29a)
Dormer Cheek	11.9700	3.5900	8.3800	0.3200	2.6816	18.0000	150.8400 (29a)
400mm Mineral Wool	14.7000		14.7000	0.1100	1.6170	9.0000	132.3000 (30)
Bay Flat	1.0500		1.0500	0.2500	0.2625	9.0000	9.4500 (30)
Sloping	23.4900	0.9000	22.5900	0.2000	4.5180	9.0000	203.3100 (30)
Dormer Roof	8.5000		8.5000	0.2800	2.3800	9.0000	76.5000 (30)
C2V	23.4700		23.4700	0.1400	3.2858	9.0000	211.2300 (30)
Total net area of external elements Aum(A, m ²)			343.2500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	103.0224	(33)
Timber GF						9.0000	1029.4200 (32c)
Timber FF						9.0000	1203.5700 (32c)
Timber 2F						9.0000	511.1100 (32c)
Internal Floor						18.0000	1159.3800 (32d)
Internal Floor 2						18.0000	736.9200 (32d)
Internal Ceiling						18.0000	1159.3800 (32e)
Internal Ceiling 2						18.0000	736.9200 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12915.2700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		75.6163 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		21.9013 (36)
Total fabric heat loss	(33) + (36) =	124.9237 (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	79.0146	78.1580	77.3013	73.0181	72.1614	70.6513	70.6513	70.6513	70.6513	72.1614	73.8747	75.5880 (38)
Heat transfer coeff	203.9383	203.0817	202.2250	197.9418	197.0852	195.5750	195.5750	195.5750	195.5750	197.0852	198.7984	200.5117 (39)
Average = Sum(39)m / 12 =												198.5806 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1940	1.1890	1.1840	1.1589	1.1539	1.1451	1.1451	1.1451	1.1451	1.1539	1.1639	1.1740 (40)
HLP (average)												1.1626 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9636 (42)											
Average daily hot water use (litres/day)	104.5865 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.0452	110.8617	106.6783	102.4948	98.3113	94.1279	94.1279	98.3113	102.4948	106.6783	110.8617	115.0452 (44)
Energy content (annual)	170.6087	149.2154	153.9770	134.2409	128.8073	111.1509	102.9976	118.1913	119.6029	139.3856	152.1503	165.2254 (45)
Distribution loss (46)m = 0.15 x (45)m	25.5913											
Water storage loss:	22.3823											
Store volume	23.0965											
a) If manufacturer declared loss factor is known (kWh/day):	20.1361											
Temperature factor from Table 2b	19.3211											
Enter (49) or (54) in (55)	16.6726											
Total storage loss	15.4496											
If cylinder contains dedicated solar storage	17.7287											
Primary loss	17.9404											
Total heat required for water heating calculated for each month	20.9078											
Aperture area of solar collector	22.8225											
Zero-loss collector efficiency	24.2962											
Collector heat loss coefficient	23.5124											
Collector 2nd order heat loss coefficient	24.2962											
Collector effective heat loss coefficient	23.5124											
Collector performance ratio	24.2962											
Annual solar radiation per m2	23.5124											
Overshading factor	24.2962											
Solar energy available	23.5124											
Adjustment factor for showers	24.2962											
Solar-to-load ratio	23.5124											
Utilisation factor	24.2962											
Collector performance factor	23.5124											
Dedicated solar storage volume	24.2962											
Effective solar volume	23.5124											
Daily hot water demand	24.2962											
Volume ratio Veff/V	23.5124											
Solar storage volume factor	24.2962											
Solar input	23.5124											
Solar input	-27.5794	-46.0220	-78.3808	-105.0457	-129.7751	-127.5896	-125.9034	-110.0025	-86.1540	-58.8330	-32.7131	-23.0792 (63)
Output from w/h	180.9973	137.4871	112.1684	59.1848	24.2059	7.6978	2.0352	34.0604	64.7892	117.1248	156.1804	180.1141 (64)
Heat gains from water heating, kWh/month	87.1018	77.0491	80.4551	68.6268	62.9673	56.2669	54.1995	59.9958	64.8402	75.6035	79.9845	85.3118 (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	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.1089	69.3757	56.4201	42.7136	31.9289	26.9558	29.1267	37.8599	50.8155	64.5220	75.3067	80.2798 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	510.9921	516.2946	502.9325	474.4861	438.5776	404.8288	382.2824	376.9799	390.3421	418.7884	454.6969	488.4458 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455 (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)	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457 (71)
Water heating gains (Table 5)	117.0723	114.6563	108.1386	95.3149	84.6335	78.1484	72.8488	80.6396	90.0558	101.6176	111.0896	114.6664 (72)
Total internal gains	824.1917	818.3450	785.5095	730.5330	673.1585	627.9513	602.2763	613.4978	649.2318	702.9464	759.1116	801.4104 (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				4.0200	10.6334		0.7200		0.7000		0.7700		14.9301 (74)
East				7.0900	19.6403		0.7200		0.7000		0.7700		48.6359 (76)
West				12.9100	19.6403		0.7200		0.7000		0.7700		88.5599 (80)
East				5.2200	19.6403		0.7200		0.7000		0.7700		35.8081 (76)
East				0.9000	26.0000		0.6300		0.7000		1.0000		9.2875 (82)
Solar gains	197.2215	386.2540	640.1254	944.3197	1169.6836	1203.5281	1143.2369	973.2336	747.5928	459.1183	245.9217		162.2179 (83)
Total gains	1021.4132	1204.5990	1425.6349	1674.8528	1842.8421	1831.4794	1745.5132	1586.7314	1396.8246	1162.0647	1005.0333		963.6283 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	17.5915	17.6657	17.7405	18.1244	18.2032	18.3437	18.3437	18.3437	18.3437	18.2032	18.0463	17.8921
alpha	2.1728	2.1777	2.1827	2.2083	2.2135	2.2229	2.2229	2.2229	2.2229	2.2135	2.2031	2.1928
util living area	0.9477	0.9251	0.8816	0.8000	0.6870	0.5521	0.4352	0.4841	0.6777	0.8530	0.9287	0.9532 (86)
MIT	18.0643	18.3993	18.9742	19.7113	20.3061	20.7045	20.8761	20.8385	20.5053	19.7045	18.7694	18.0257 (87)
Th 2	19.9248	19.9288	19.9328	19.9530	19.9571	19.9642	19.9642	19.9642	19.9642	19.9571	19.9490	19.9409 (88)
util rest of house	0.9410	0.9157	0.8665	0.7742	0.6450	0.4878	0.3489	0.3967	0.6195	0.8279	0.9182	0.9473 (89)
MIT 2	16.0095	16.4922	17.3156	18.3613	19.1719	19.6844	19.8762	19.8428	19.4583	18.3782	17.0410	15.9596 (90)
Living area fraction									fLA = Living area / (4) =			0.1011 (91)
MIT	16.2173	16.6850	17.4833	18.4978	19.2866	19.7875	19.9773	19.9435	19.5642	18.5123	17.2158	16.1685 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.0673	16.5350	17.3333	18.3478	19.1366	19.6375	19.8273	19.7935	19.4142	18.3623	17.0658	16.0185 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9038	0.8719	0.8165	0.7253	0.6071	0.4655	0.3366	0.3810	0.5834	0.7771	0.8754	0.9126 (94)
Useful gains	923.1806	1050.3110	1164.0634	1214.8274	1118.7781	852.4959	587.5385	604.4982	814.8958	902.9970	879.7581	879.3788 (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	2399.8040	2362.8576	2190.7734	1870.1107	1465.6353	985.2173	631.1816	663.6817	1039.3228	1529.8299	1981.1792	2369.7530 (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	1098.6078	882.0313	763.8722	471.8040	258.0617	0.0000	0.0000	0.0000	0.0000	466.3637	793.0232	1108.8384 (98)
Space heating												5842.6022 (98)
Space heating per m2										(98) / (4) =		34.2073 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)		0.0000 (201)
Fraction of space heat from main system(s)		1.0000 (202)
Efficiency of main space heating system 1 (in %)		90.4000 (206)
Efficiency of secondary/supplementary heating system, %		0.0000 (208)
Space heating requirement		6463.0555 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1098.6078	882.0313	763.8722	471.8040	258.0617	0.0000	0.0000	0.0000	0.0000	466.3637	793.0232	1108.8384 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	1215.2741	975.6983	844.9914	521.9070	285.4665	0.0000	0.0000	0.0000	0.0000	515.8890	877.2381	1226.5911 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	180.9973	137.4871	112.1684	59.1848	24.2059	7.6978	2.0352	34.0604	64.7892	117.1248	156.1804	180.1141 (64)
Efficiency of water heater (217)m	88.7153	88.7924	88.8723	89.0672	89.3711	79.7000	79.7000	79.7000	79.7000	88.0277	88.4462	79.7000 (216)
Fuel for water heating, kWh/month	204.0204	154.8410	126.2130	66.4496	27.0847	9.6585	2.5536	42.7357	81.2914	133.0544	176.5823	202.9791 (219)
Water heating fuel used												1227.4637 (219)
Annual totals kWh/year												
Space heating fuel - main system												6463.0555 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:
 (MEVDecentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)
 mechanical ventilation fans (SFP = 0.2308)
 central heating pump
 main heating flue fan
 pump for solar water heating
 Total electricity for the above, kWh/year
 Electricity for lighting (calculated in Appendix L)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV Unit 0 (0.80 * 0.96 * 1004 * 1.00) = -771.0691
 Total delivered energy for all uses -771.0691 (233)
 7716.7953 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6463.0555	3.4800	224.9143 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1227.4637	3.4800	42.7157 (247)
Mechanical ventilation fans	120.5738	13.1900	15.9037 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	551.7714	13.1900	72.7786 (250)
Additional standing charges			120.0000 (251)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-771.0691	13.1900	-101.7040 (252)
Total energy cost			391.0959 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7612 (257)
SAP value		89.3817
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	6463.0555	0.2160	1396.0200 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1227.4637	0.2160	265.1322 (264)
Space and water heating			1661.1521 (265)
Pumps and fans	245.5738	0.5190	127.4528 (267)
Energy for lighting	551.7714	0.5190	286.3693 (268)
Energy saving/generation technologies			
PV Unit	-771.0691	0.5190	-400.1849 (269)
Total kg/year			1674.7894 (272)
CO2 emissions per m2			9.8100 (273)
EI value			89.6005
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	65.4500 (1b)	x 2.4000 (2b)	= 157.0800 (1b) - (3b)
First floor	64.4100 (1c)	x 2.6900 (2c)	= 173.2629 (1c) - (3c)
Second floor	40.9400 (1d)	x 2.3900 (2d)	= 97.8466 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	170.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 428.1895 (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					0 * 10 = 0.0000 (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) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.8500
Infiltration rate					0.2425 (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) =				0.2425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.2668	0.2486	0.2486	0.2364	0.2364	0.2243	0.2243	0.2122	0.2122	0.2304	0.2243	0.2364 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5168	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			4.2500	1.3000	5.5250		(26)
Window (Uw = 1.40)			24.0200	1.3258	31.8447		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
Roof Window (Uw = 1.80)			0.9000	1.6791	1.5112		(27a)
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000 (28a)
140mm Timber Frame	193.8600	29.9000	163.9600	0.1900	31.1524	9.0000	1475.6400 (29a)
W2V	14.8500		14.8500	0.1400	2.0790	18.0000	267.3000 (29a)
Dormer Cheek	11.9700	3.5900	8.3800	0.3200	2.6816	18.0000	150.8400 (29a)
400mm Mineral Wool	14.7000		14.7000	0.1100	1.6170	9.0000	132.3000 (30)
Bay Flat	1.0500		1.0500	0.2500	0.2625	9.0000	9.4500 (30)
Sloping	23.4900	0.9000	22.5900	0.2000	4.5180	9.0000	203.3100 (30)
Dormer Roof	8.5000		8.5000	0.2800	2.3800	9.0000	76.5000 (30)
C2V	23.4700		23.4700	0.1400	3.2858	9.0000	211.2300 (30)
Total net area of external elements Aum(A, m ²)			343.2500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	103.0224	(33)
Timber GF						9.0000	1029.4200 (32c)
Timber FF						9.0000	1203.5700 (32c)
Timber 2F						9.0000	511.1100 (32c)
Internal Floor						18.0000	1159.3800 (32d)
Internal Floor 2						18.0000	736.9200 (32d)
Internal Ceiling						18.0000	1159.3800 (32e)
Internal Ceiling 2						18.0000	736.9200 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =											12915.2700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K												75.6163 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												21.9013 (36)
Total fabric heat loss	(33) + (36) =											124.9237 (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	73.0181	70.6513	70.6513	70.6513	70.6513	70.6513	70.6513	70.6513	70.6513	70.6513	70.6513	70.6513 (38)
Heat transfer coeff	197.9418	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750	195.5750 (39)
Average = Sum(39)m / 12 =												195.7722 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1589	1.1451	1.1451	1.1451	1.1451	1.1451	1.1451	1.1451	1.1451	1.1451	1.1451	1.1451 (40)
HLP (average)												1.1462 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9636 (42)
Average daily hot water use (litres/day)													104.5865 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.0452	110.8617	106.6783	102.4948	98.3113	94.1279	94.1279	98.3113	102.4948	106.6783	110.8617	115.0452	(44)
Energy content (annual)	170.6087	149.2154	153.9770	134.2409	128.8073	111.1509	102.9976	118.1913	119.6029	139.3856	152.1503	165.2254	(45)
Distribution loss (46)m = 0.15 x (45)m	25.5913	22.3823	23.0965	20.1361	19.3211	16.6726	15.4496	17.7287	17.9404	20.9078	22.8225	24.7838	(46)
Water storage loss:													
Store volume													190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.4514 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7837 (55)
Total storage loss	24.2962	21.9449	24.2962	23.5124	24.2962	23.5124	24.2962	24.2962	23.5124	24.2962	23.5124	24.2962	(56)
If cylinder contains dedicated solar storage	14.7056	13.2824	14.7056	14.2312	14.7056	14.2312	14.7056	14.7056	14.2312	14.7056	14.2312	14.7056	(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	208.5766	183.5091	190.5492	164.2304	153.9809	135.2874	127.9387	144.0628	150.9432	175.9579	188.8935	203.1934	(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													1200.5924 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													2016.9953 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.2257 (H8)
Utilisation factor													0.5577 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													109.5000 (H13)
Daily hot water demand													104.5865 (H14)
Volume ratio Veff/V													1.0470 (H15)
Solar storage volume factor													1.0000 (H16)
Solar input													-989.1585 (H17)
Solar input	-32.4719	-46.1730	-79.3602	-107.0753	-125.1438	-134.9276	-128.4405	-117.0651	-91.4749	-62.9080	-38.4057	-25.7124	(63)
Solar input (sum of months) = Sum(63)m =													-989.1585 (63)
Output from w/h	176.1047	137.3361	111.1890	57.1551	28.8371	0.3598	0.0000	26.9977	59.4683	113.0498	150.4878	177.4810	(64)
Total per year (kWh/year) = Sum(64)m =													1038.4664 (64)
Heat gains from water heating, kWh/month	87.1018	77.0491	80.4551	68.6268	62.9673	56.2669	54.1995	59.9958	64.8402	75.6035	79.9845	85.3118	(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	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	177.8186	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.1089	69.3757	56.4201	42.7136	31.9289	26.9558	29.1267	37.8599	50.8155	64.5220	75.3067	80.2798	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	510.9921	516.2946	502.9325	474.4861	438.5776	404.8288	382.2824	376.9799	390.3421	418.7884	454.6969	488.4458	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	55.7455	(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)	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	-118.5457	(71)
Water heating gains (Table 5)	117.0723	114.6563	108.1386	95.3149	84.6335	78.1484	72.8488	80.6396	90.0558	101.6176	111.0896	114.6664	(72)
Total internal gains	824.1917	818.3450	785.5095	730.5330	673.1585	627.9513	602.2763	613.4978	649.2318	702.9464	759.1116	801.4104	(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				4.0200	13.4839		0.7200		0.7000		0.7700		18.9324 (74)
East				7.0900	25.1925		0.7200		0.7000		0.7700		62.3853 (76)
West				12.9100	25.1925		0.7200		0.7000		0.7700		113.5957 (80)
East				5.2200	25.1925		0.7200		0.7000		0.7700		45.9310 (76)
East				0.9000	34.0000		0.6300		0.7000		1.0000		12.1451 (82)
Solar gains	252.9895	421.8457	703.6527	1040.7525	1215.4800	1369.5058	1255.7362	1118.1963	860.4245	533.9724	314.5075		196.9141 (83)
Total gains	1077.1812	1240.1907	1489.1622	1771.2855	1888.6385	1997.4571	1858.0125	1731.6940	1509.6563	1236.9187	1073.6191		998.3245 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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FULL SAP CALCULATION PRINTOUT

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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	18.1244	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437	18.3437
alpha	2.2083	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229	2.2229
util living area	0.9341	0.9102	0.8534	0.7537	0.6182	0.4396	0.3250	0.3455	0.5806	0.8002	0.9044	0.9416 (86)
MIT	18.4575	18.7592	19.3420	19.9973	20.5363	20.8534	20.9490	20.9422	20.7073	20.0538	19.1659	18.4312 (87)
Th 2	19.9530	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642	19.9642 (88)
util rest of house	0.9255	0.8988	0.8345	0.7220	0.5665	0.3654	0.2308	0.2464	0.5070	0.7648	0.8898	0.9338 (89)
MIT 2	16.5884	17.0246	17.8523	18.7604	19.4746	19.8473	19.9390	19.9353	19.7005	18.8652	17.6168	16.5563 (90)
Living area fraction	16.7773	17.2000	18.0029	18.8855	19.5820	19.9491	20.0411	20.0371	19.8023	18.9854	17.7734	16.7459 (91)
MIT	16.6273	17.0500	17.8529	18.7355	19.4320	19.7991	19.8911	19.8871	19.6523	18.8354	17.6234	16.5959 (92)
Temperature adjustment												-0.1500
adjusted MIT												16.5959 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8846	0.8532	0.7846	0.6772	0.5369	0.3527	0.2238	0.2386	0.4821	0.7161	0.8427	0.8953 (94)
Useful gains	952.8611	1058.1067	1168.4173	1199.4692	1013.9285	704.5154	415.7627	413.1906	727.8721	885.7024	904.7655	893.8132 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	2222.3619	2180.6607	2005.2091	1708.4363	1238.3770	762.5569	428.5211	427.7395	851.2077	1336.8251	1803.8693	2170.0749 (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	944.5086	754.3563	622.5731	366.4563	166.9897	0.0000	0.0000	0.0000	0.0000	335.6353	647.3547	949.5387 (98)
Space heating												4787.4127 (98)
Space heating per m2										(98) / (4) =		28.0293 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5295.8105 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	944.5086	754.3563	622.5731	366.4563	166.9897	0.0000	0.0000	0.0000	0.0000	335.6353	647.3547	949.5387 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	1044.8104	834.4650	688.6871	405.3720	184.7231	0.0000	0.0000	0.0000	0.0000	371.2780	716.1003	1050.3746 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	176.1047	137.3361	111.1890	57.1551	28.8371	0.3598	0.0000	26.9977	59.4683	113.0498	150.4878	177.4810 (64)
Efficiency of water heater	88.5322	88.5686	88.5976	88.7916	88.6474	79.7000	79.7000	79.7000	79.7000	87.4422	88.1674	79.7000 (216)
(217)m												88.5283 (217)
Fuel for water heating, kWh/month	198.9162	155.0618	125.4988	64.3699	32.5301	0.4514	0.0000	33.8742	74.6152	129.2853	170.6843	200.4793 (219)
Water heating fuel used												1185.7664 (219)
Annual totals kWh/year												
Space heating fuel - main system												5295.8105 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)												
mechanical ventilation fans (SFP = 0.2308)												120.5738 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												245.5738 (231)
Electricity for lighting (calculated in Appendix L)												551.7714 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.96 * 1115 * 1.00) =										-856.2413		-856.2413 (233)
Total delivered energy for all uses												6422.6807 (238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5295.8105	7.6100	403.0112 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1185.7664	7.6100	90.2368 (247)
Mechanical ventilation fans	120.5738	31.0800	37.4743 (249)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Pump for solar water heating	50.0000	31.0800	15.5400 (249)
Energy for lighting	551.7714	31.0800	171.4905 (250)
Additional standing charges			105.0000 (251)

FULL SAP CALCULATION PRINTOUT

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Energy saving/generation technologies			
PV Unit	-856.2413	31.0800	-266.1198 (252)
Total energy cost			579.9431 (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	5295.8105	0.2160	1143.8951 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1185.7664	0.2160	256.1255 (264)
Space and water heating			1400.0206 (265)
Pumps and fans	245.5738	0.5190	127.4528 (267)
Energy for lighting	551.7714	0.5190	286.3693 (268)
Energy saving/generation technologies			
PV Unit	-856.2413	0.5190	-444.3893 (269)
Total kg/year			1369.4535 (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	5295.8105	1.2200	6460.8888 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1185.7664	1.2200	1446.6350 (264)
Space and water heating			7907.5238 (265)
Pumps and fans	245.5738	3.0700	753.9116 (267)
Energy for lighting	551.7714	3.0700	1693.9381 (268)
Energy saving/generation technologies			
PV Unit	-856.2413	3.0700	-2628.6609 (269)
Primary energy kWh/year			7726.7126 (272)
Primary energy kWh/m2/year			45.2384 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	75.6 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	565.21 (P1)
Transmission heat loss coefficient	124.92 (P2)
Summer heat loss coefficient	690.13 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
East	1.000	1.00	1.000	1.000 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.0200	87.1704	0.7200	0.7000	0.9000	143.0576
East	7.0900	125.2818	0.7200	0.7000	0.9000	362.6183
West	12.9100	125.2818	0.7200	0.7000	0.9000	660.2824
East	5.2200	125.2818	0.7200	0.7000	0.9000	266.9771
East	0.9000	217.0000	0.6300	0.7000	1.0000	77.5146
total:						1510.4499

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Solar gains	1628	1510	1317	(P3)
Internal gains	648	623	633	
Total summer gains	2276	2133	1950	(P5)
Summer gain/loss ratio	3.30	3.09	2.83	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 75.6)	1.47	1.47	1.47	
Threshold temperature	20.17	21.86	21.60	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			