

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-237			Issued on Date	05/01/2024
Assessment Reference	As Built	Prop Type Ref	L Det As		
Property	66, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	86 B	DER	14.78	TER	18.90
Environmental	87 B	% DER<TER	21.79		
CO ₂ Emissions (t/year)	1.14	DFEE	51.70	TFEE	61.77
General Requirements Compliance	Pass	% DFEE<TFEE	16.30		
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 94 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.90 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.78 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.30 (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	0.11 (max. 0.20)	0.30 (max. 0.35)	OK
Openings	1.43 (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: 4.18 (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: 1.11 kWh/day
Permitted by DBSCG 1.66 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): Medium OK

Based on:

Overshading: Average
Windows facing North East: 4.95 m², No overhang
Windows facing South West: 8.18 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.66 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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																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															4.1800		
Infiltration rate															0.2090 (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) =					0.2090 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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																	
	0.2665	0.2613	0.2560	0.2299	0.2247	0.1986	0.1986	0.1933	0.2090	0.2247	0.2351	0.2456 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5165	0.5113	0.5060	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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1800	7.3260	75.0000	3052.5000 (28a)
140mm Timber Frame	141.4700	15.2500	126.2200	0.1900	23.9818	9.0000	1135.9800 (29a)
Rooflight Stud Wall	5.4000		5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			249.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.9938		(33)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber FF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			18.0000	559.8000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7447.4700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.4821 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.1047 (36)
Total fabric heat loss						(33) + (36) =	84.0985 (37)

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

(38)m	Jan 40.3395	Feb 39.9314	Mar 39.5233	Apr 39.0527	May 39.0527	Jun 39.0527	Jul 39.0527	Aug 39.0527	Sep 39.0527	Oct 39.0527	Nov 39.0527	Dec 39.0527 (38)
Heat transfer coeff	124.4380	124.0299	123.6218	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512 (39)
Average = Sum(39)m / 12 =												123.3709 (39)
HLP	Jan 1.3280	Feb 1.3237	Mar 1.3193	Apr 1.3143	May 1.3143	Jun 1.3143	Jul 1.3143	Aug 1.3143	Sep 1.3143	Oct 1.3143	Nov 1.3143	Dec 1.3143 (40)
HLP (average)												1.3167 (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	2.6731 (42)
Average daily hot water use (litres/day)	97.6851 (43)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536	(44)
Energy conte	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225	(45)
Energy content (annual)	Total = Sum (45)m =												1536.9663 (45)
Distribution loss (46)m = 0.15 x (45)m	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484	(46)
Water storage loss:													
Store volume													120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.1100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(56)
If cylinder contains dedicated solar storage	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(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	201.1943	177.1634	185.6601	165.8765	162.1513	144.3103	138.0448	152.2359	152.2045	172.0316	182.6042	196.1663	(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	201.1943	177.1634	185.6601	165.8765	162.1513	144.3103	138.0448	152.2359	152.2045	172.0316	182.6042	196.1663	(64)
Heat gains from water heating, kWh/month	86.4591	76.5757	81.2940	74.0849	73.4773	66.9141	65.4619	70.1804	69.5389	76.7625	79.6468	84.7873	(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	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.7068	20.1680	16.4017	12.4172	9.2820	7.8362	8.4673	11.0061	14.7724	18.7570	21.8922	23.3379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.7226	248.2724	241.8469	228.1678	210.9004	194.6714	183.8295	181.2797	187.7052	201.3843	218.6517	234.8806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	(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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	(71)
Water heating gains (Table 5)	116.2085	113.9519	109.2661	102.8957	98.7598	92.9363	87.9864	94.3285	96.5819	103.1754	110.6206	113.9614	(72)
Total internal gains	450.7337	448.4882	433.6105	409.5765	385.0380	361.5397	346.3790	352.7101	365.1553	389.4125	417.2603	438.2757	(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	
Northeast				4.9500	11.2829	0.7200	0.7000	0.7700			19.5070 (75)	
Southwest				3.6600	36.7938	0.7200	0.7000	0.7700			47.0349 (79)	
Southwest				4.5200	36.7938	0.7200	0.7000	0.7700			58.0868 (79)	
Southwest				1.9700	34.0172	0.6300	0.7000	1.0000			26.5978 (82)	

Solar gains	151.2265	270.5335	401.6163	545.6051	651.4821	663.6054	632.8483	551.8929	451.4905	307.7606	183.5612	127.8099 (83)
Total gains	601.9601	719.0217	835.2269	955.1816	1036.5200	1025.1452	979.2274	904.6031	816.6457	697.1731	600.8215	566.0856 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	16.6247	16.6794	16.7344	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	
alpha	2.1083	2.1120	2.1156	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	
util living area	0.9468	0.9228	0.8830	0.8136	0.7127	0.5869	0.4697	0.5132	0.6929	0.8523	0.9267	0.9526	(86)
MIT	17.9351	18.2860	18.8492	19.5437	20.1695	20.6191	20.8326	20.7912	20.4201	19.5977	18.6408	17.8756	(87)
Th 2	19.8189	19.8223	19.8257	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	(88)
util rest of house	0.9394	0.9124	0.8668	0.7864	0.6676	0.5143	0.3682	0.4123	0.6287	0.8247	0.9150	0.9461	(89)
MIT 2	15.7742	16.2773	17.0812	18.0580	18.9088	19.4819	19.7188	19.6825	19.2572	18.1567	16.7979	15.6920	(90)
Living area fraction	15.9841	16.4724	17.2529	18.2023	19.0312	19.5923	19.8270	19.7902	19.3701	18.2966	16.9769	15.9041	(91)
Temperature adjustment	15.8341	16.3224	17.1029	18.0523	18.8812	19.4423	19.6770	19.6402	19.2201	18.1466	16.8269	-0.1500	(92)
adjusted MIT	15.8341	16.3224	17.1029	18.0523	18.8812	19.4423	19.6770	19.6402	19.2201	18.1466	16.8269	15.7541	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	541.9785	622.8248	680.4195	700.8305	646.9939	499.3486	346.1967	356.3769	480.5713	537.2546	522.3496	514.8914	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fraction	1435.2795	1416.7190	1310.7497	1127.1201	884.3789	596.3403	378.9328	399.0353	630.5470	929.3779	1197.8786	1422.9005 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating requirement	664.6159	533.4969	468.9657	306.9285	176.6145	0.0000	0.0000	0.0000	0.0000	291.7397	486.3809	675.5587 (98)
Space heating requirement												3604.3008 (98)
Space heating requirement per m2											(98) / (4) =	38.4664 (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												3987.0584 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	664.6159	533.4969	468.9657	306.9285	176.6145	0.0000	0.0000	0.0000	0.0000	291.7397	486.3809	675.5587 (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)	735.1946	590.1514	518.7674	339.5227	195.3700	0.0000	0.0000	0.0000	0.0000	322.7209	538.0319	747.2995 (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	201.1943	177.1634	185.6601	165.8765	162.1513	144.3103	138.0448	152.2359	152.2045	172.0316	182.6042	196.1663 (64)
Efficiency of water heater	87.6651	87.4724	87.0842	86.3336	84.9416	79.7000	79.7000	79.7000	79.7000	86.1116	87.2044	79.7000 (216)
Fuel for water heating, kWh/month	229.5034	202.5363	213.1961	192.1344	190.8975	181.0668	173.2056	191.0111	190.9718	199.7775	209.3980	223.5539 (219)
Water heating fuel used												2397.2523 (219)
Annual totals kWh/year												
Space heating fuel - main system												3987.0584 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												66.2494 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												141.2494 (231)
Electricity for lighting (calculated in Appendix L)												401.0095 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1004 * 1.00) =									-530.1100			-530.1100 (233)
Total delivered energy for all uses												6396.4595 (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	3987.0584	0.2160	861.2046 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2397.2523	0.2160	517.8065 (264)
Space and water heating			1379.0111 (265)
Pumps and fans	141.2494	0.5190	73.3084 (267)
Energy for lighting	401.0095	0.5190	208.1239 (268)
Energy saving/generation technologies			
PV Unit	-530.1100	0.5190	-275.1271 (269)
Total CO2, kg/year			1385.3164 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7800 (273)

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

DER			14.7800 ZC1
Total Floor Area		TFA	93.7000
Assumed number of occupants		N	2.6731
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.5400 ZC2
CO2 emissions from cooking, equation (L16)			1.9547 ZC3
Total CO2 emissions			32.2747 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			32.2747 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 236.6830 (5)
Dwelling volume			

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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1268 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3768 (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) =	0.3768 (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	0.4804	0.4709	0.4615	0.4144	0.4050	0.3579	0.3579	0.3485	0.3768	0.4050	0.4238	0.4427 (22b)
Effective ac	0.6154	0.6109	0.6065	0.5859	0.5820	0.5641	0.5641	0.5607	0.5710	0.5820	0.5898	0.5980 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			13.1300	1.3258	17.4072		(27)
TER Room Window (Uw = 1.70)			1.9700	1.5918	3.1358		(27a)
150mm EPS B&B			40.7000	0.1300	5.2910		(28a)
140mm Timber Frame	141.4700	15.2500	126.2200	0.1800	22.7196		(29a)
Rooflight Stud Wall	5.4000		5.4000	0.1800	0.9720		(29a)
400mm Mineral Wool	59.6000		59.6000	0.1300	7.7480		(30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.1300	0.0169		(30)
Total net area of external elements Aum(A, m ²)			249.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.4105		(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)							18.7237 (36)
Total fabric heat loss						(33) + (36) =	78.1342 (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	48.0639	47.7140	47.3710	45.7600	45.4586	44.0554	44.0554	43.7956	44.5959	45.4586	46.0683	46.7058 (38)
Heat transfer coeff	126.1980	125.8481	125.5051	123.8941	123.5927	122.1896	122.1896	121.9298	122.7301	123.5927	124.2025	124.8400 (39)
Average = Sum(39)m / 12 =												123.8927 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3468	1.3431	1.3394	1.3222	1.3190	1.3041	1.3041	1.3013	1.3098	1.3190	1.3255	1.3323 (40)
HLP (average)												1.3222 (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												2.6731 (42)
Average daily hot water use (litres/day)												97.6851 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536 (44)
Energy conte	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225 (45)
Energy content (annual)										Total = Sum(45)m =		1536.9663 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Store volume												120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2247 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6613 (55)
Total storage loss												
20.5007	18.5168	20.5007	19.8394	20.5007	19.8394	20.5007	20.5007	19.8394	20.5007	19.8394	20.5007	(56)
If cylinder contains dedicated solar storage												
20.5007	18.5168	20.5007	19.8394	20.5007	19.8394	20.5007	20.5007	19.8394	20.5007	19.8394	20.5007	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
203.1136	178.8970	187.5794	167.7339	164.0706	146.1676	139.9641	154.1552	154.0619	173.9509	184.4616	198.0856	(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	(63)
Solar input (sum of months) = Sum(63)m =												
Output from w/h												
203.1136	178.8970	187.5794	167.7339	164.0706	146.1676	139.9641	154.1552	154.0619	173.9509	184.4616	198.0856	(64)
Heat gains from water heating, kWh/month												
87.9945	77.9626	82.8294	75.5708	75.0127	68.4000	66.9973	71.7159	71.0249	78.2979	81.1328	86.3227	(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	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
22.7068	20.1680	16.4017	12.4172	9.2820	7.8362	8.4673	11.0061	14.7724	18.7570	21.8922	23.3379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
245.7226	248.2724	241.8469	228.1678	210.9004	194.6714	183.8295	181.2797	187.7052	201.3843	218.6517	234.8806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	(71)
Water heating gains (Table 5)												
118.2722	116.0157	111.3298	104.9595	100.8236	95.0000	90.0502	96.3923	98.6456	105.2392	112.6844	116.0251	(72)
Total internal gains												
452.7974	450.5519	435.6743	411.6402	387.1017	363.6035	348.4428	354.7739	367.2190	391.4762	419.3241	440.3395	(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		
Northeast				4.9500	11.2829			0.6300	0.7000	0.7700	17.0687 (75)	
Southwest				8.1800	36.7938			0.6300	0.7000	0.7700	91.9814 (79)	
Southwest				1.9700	34.0172			0.6300	0.7000	1.0000	26.5978 (82)	
Solar gains	135.6479	243.1875	362.0490	492.9733	589.2387	600.3644	572.4798	498.9163	407.4337	276.9574	164.7542	114.5733 (83)
Total gains	588.4453	693.7394	797.7233	904.6135	976.3405	963.9679	920.9226	853.6902	774.6527	668.4336	584.0783	554.9128 (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	51.5614	51.7047	51.8460	52.5202	52.6483	53.2528	53.2528	53.3663	53.0183	52.6483	52.3898	52.1223
alpha	4.4374	4.4470	4.4564	4.5013	4.5099	4.5502	4.5502	4.5578	4.5346	4.5099	4.4927	4.4748
util living area												
	0.9975	0.9944	0.9856	0.9565	0.8784	0.7252	0.5617	0.6202	0.8538	0.9741	0.9949	0.9981 (86)
MIT	19.5287	19.7061	19.9986	20.3840	20.7163	20.9191	20.9802	20.9694	20.8194	20.3833	19.8876	19.5027 (87)
Th 2	19.8043	19.8072	19.8101	19.8235	19.8260	19.8377	19.8377	19.8398	19.8331	19.8260	19.8209	19.8156 (88)
util rest of house												
	0.9966	0.9924	0.9803	0.9393	0.8299	0.6253	0.4243	0.4813	0.7778	0.9607	0.9928	0.9974 (89)
MIT 2	17.8625	18.1231	18.5492	19.1066	19.5496	19.7846	19.8307	19.8277	19.6890	19.1166	18.3982	17.8321 (90)
Living area fraction												
MIT	18.0243	18.2768	18.6900	19.2306	19.6629	19.8947	19.9423	19.9385	19.7988	19.2396	18.5428	17.9944 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0243	18.2768	18.6900	19.2306	19.6629	19.8947	19.9423	19.9385	19.7988	19.2396	18.5428	17.9944 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9945	0.9885	0.9729	0.9278	0.8218	0.6308	0.4373	0.4940	0.7751	0.9511	0.9891	0.9957 (94)
Useful gains	585.2078	685.7616	776.1410	839.3153	802.3123	608.0445	402.7166	421.7179	600.4504	635.7234	577.6974	552.5396 (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												
	1731.9840	1683.4480	1529.9061	1279.9046	984.1535	646.9631	408.3988	431.4525	699.4088	1067.7936	1421.2280	1722.0903 (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												
	853.2015	670.4453	560.8012	317.2242	135.2898	0.0000	0.0000	0.0000	0.0000	321.4602	607.3420	870.1457 (98)
Space heating												4335.9100 (98)
Space heating per m2											(98) / (4) =	46.2744 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4637.3369	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	853.2015	670.4453	560.8012	317.2242	135.2898	0.0000	0.0000	0.0000	0.0000	321.4602	607.3420	870.1457	(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)	912.5149	717.0538	599.7874	339.2773	144.6950	0.0000	0.0000	0.0000	0.0000	343.8077	649.5637	930.6371	(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	203.1136	178.8970	187.5794	167.7339	164.0706	146.1676	139.9641	154.1552	154.0619	173.9509	184.4616	198.0856	(64)	
Efficiency of water heater (217)m	88.2253	88.0143	87.5574	86.4889	84.3046	79.8000	79.8000	79.8000	79.8000	86.4308	87.7587	88.3044	(216)	
Fuel for water heating, kWh/month	230.2215	203.2590	214.2360	193.9368	194.6165	183.1675	175.3936	193.1769	193.0600	201.2604	210.1918	224.3213	(219)	
Water heating fuel used												2416.8414	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4637.3369	(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)													401.0095	(232)
Total delivered energy for all uses													7530.1878	(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	4637.3369	0.2160	1001.6648 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2416.8414	0.2160	522.0377 (264)
Space and water heating			1523.7025 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	401.0095	0.5190	208.1239 (268)
Total CO2, kg/m2/year			1770.7514 (272)
Emissions per m2 for space and water heating			16.2615 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2212 (272b)
Emissions per m2 for pumps and fans			0.4154 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2615 * 1.00) + 2.2212 + 0.4154, rounded to 2 d.p.			18.9000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1268 (8)
Pressure test					Yes
Measured/design AP50					4.1800
Infiltration rate					0.3358 (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) =	0.3358 (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	0.4281	0.4197	0.4113	0.3693	0.3609	0.3190	0.3190	0.3106	0.3358	0.3609	0.3777	0.3945 (22b)
Effective ac	0.5916	0.5881	0.5846	0.5682	0.5651	0.5509	0.5509	0.5482	0.5564	0.5651	0.5713	0.5778 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1800	7.3260	75.0000	3052.5000 (28a)
140mm Timber Frame	141.4700	15.2500	126.2200	0.1900	23.9818	9.0000	1135.9800 (29a)
Rooflight Stud Wall			5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			249.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.9938		(33)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber FF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			9.0000	279.9000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7167.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							76.4949 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.1047 (36)
Total fabric heat loss							(33) + (36) = 84.0985 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	46.2093	45.9314	45.6590	44.3796	44.1402	43.0258	43.0258	42.8195	43.4551	44.1402	44.6245	45.1307 (38)
Average = Sum(39)m / 12 =	130.3078	130.0299	129.7575	128.4781	128.2387	127.1243	127.1243	126.9180	127.5536	128.2387	128.7230	129.2292 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3907	1.3877	1.3848	1.3712	1.3686	1.3567	1.3567	1.3545	1.3613	1.3686	1.3738	1.3792 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

												2.6731 (42)
Average daily hot water use (litres/day)												97.6851 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536 (44)
Energy content (annual)	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1536.9663 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
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	33.8620	29.6159	30.5610	26.6438	25.5654	22.0610	20.4427	23.4583	23.7385	27.6649	30.1984	32.7935 (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)
(66)m	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.7068	20.1680	16.4017	12.4172	9.2820	7.8362	8.4673	11.0061	14.7724	18.7570	21.8922	23.3379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.7226	248.2724	241.8469	228.1678	210.9004	194.6714	183.8295	181.2797	187.7052	201.3843	218.6517	234.8806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	(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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	(71)
Water heating gains (Table 5)	45.5134	44.0713	41.0766	37.0053	34.3620	30.6402	27.4768	31.5300	32.9701	37.1840	41.9422	44.0773	(72)
Total internal gains	377.0386	375.6075	362.4210	340.6860	317.6402	296.2437	282.8694	286.9116	298.5435	320.4211	345.5819	365.3917	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.9500	11.2829	0.7200	0.7000	0.7700	19.5070	(75)
Southwest	3.6600	36.7938	0.7200	0.7000	0.7700	47.0349	(79)
Southwest	4.5200	36.7938	0.7200	0.7000	0.7700	58.0868	(79)
Southwest	1.9700	34.0172	0.6300	0.7000	1.0000	26.5978	(82)

Solar gains	151.2265	270.5335	401.6163	545.6051	651.4821	663.6054	632.8483	551.8929	451.4905	307.7606	183.5612	127.8099	(83)
Total gains	528.2651	646.1410	764.0373	886.2912	969.1223	959.8491	915.7177	838.8045	750.0340	628.1817	529.1432	493.2016	(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	15.2791	15.3118	15.3439	15.4967	15.5257	15.6618	15.6618	15.6872	15.6091	15.5257	15.4673	15.4067	
alpha	2.0186	2.0208	2.0229	2.0331	2.0350	2.0441	2.0441	2.0458	2.0406	2.0350	2.0312	2.0271	
util living area	0.9559	0.9338	0.8973	0.8324	0.7371	0.6147	0.4991	0.5452	0.7231	0.8727	0.9392	0.9613	(86)
MIT	17.6185	17.9815	18.5748	19.3349	20.0242	20.5417	20.7904	20.7405	20.3089	19.3974	18.3684	17.5514	(87)
Th 2	19.7705	19.7728	19.7750	19.7855	19.7875	19.7967	19.7967	19.7984	19.7931	19.7875	19.7835	19.7793	(88)
util rest of house	0.9497	0.9246	0.8825	0.8066	0.6930	0.5411	0.3926	0.4404	0.6602	0.8476	0.9291	0.9558	(89)
MIT 2	16.7065	17.0655	17.6492	18.3920	19.0416	19.5071	19.7005	19.6714	19.3205	18.4699	17.4599	16.6458	(90)
Living area fraction	16.7951	17.1544	17.7391	18.4836	19.1370	19.6076	19.8064	19.7752	19.4165	18.5600	17.5482	16.7337	(91)
MIT	16.7951	17.1544	17.7391	18.4836	19.1370	19.6076	19.8064	19.7752	19.4165	18.5600	17.5482	16.7337	(92)
Temperature adjustment	16.7951	17.1544	17.7391	18.4836	19.1370	19.6076	19.8064	19.7752	19.4165	18.5600	17.5482	16.7337	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9280	0.8973	0.8500	0.7725	0.6651	0.5280	0.3935	0.4381	0.6368	0.8142	0.9031	0.9358	(94)
Ext temp.	490.2049	579.8119	649.4260	684.6164	644.5908	506.7975	360.3464	367.5044	477.6017	511.4914	477.8493	461.5404	(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	1628.2108	1593.4409	1458.3530	1231.2763	953.7159	636.5904	407.6097	428.3773	678.1383	1020.7786	1344.9185	1619.7236	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	846.6764	681.1587	601.8417	393.5952	229.9891	0.0000	0.0000	0.0000	0.0000	378.9097	624.2898	861.6883	(98)
Space heating per m2												4618.1489	(98)
										(98) / (4) =		49.2865	(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	
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1194.9688	940.7201	964.5766	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6721	0.7347	0.7029	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	803.0930	691.1458	677.9668	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1196.9794	1144.5750	1060.2302	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	283.5983	337.3514	284.4040	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			905.3536	(104)
Intermittency factor (Table 10b)												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	70.8996	84.3378	71.1010	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												226.3384	(107)
Energy for space heating												2.4156	(108)
Energy for space cooling												49.2865	(99)
Total												2.4156	(108)
Dwelling Fabric Energy Efficiency (DFEE)												51.7021	(109)
												51.7	(109)

FULL SAP CALCULATION PRINTOUT

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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour
										heating	heating			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)		
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)		
Number of intermittent fans											3 * 10 =	30.0000 (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) =										30.0000	/ (5) =	0.1268 (8)	
Pressure test												Yes		
Measured/design AP50												5.0000		
Infiltration rate												0.3768 (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) =	0.3768 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)		
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)		
	0.4804	0.4709	0.4615	0.4144	0.4050	0.3579	0.3579	0.3485	0.3768	0.4050	0.4238	0.4427 (22b)		
Effective ac	0.6154	0.6109	0.6065	0.5859	0.5820	0.5641	0.5641	0.5607	0.5710	0.5820	0.5898	0.5980 (25)		

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			13.1300	1.3258	17.4072		(27)					
TER Room Window (Uw = 1.70)			1.9700	1.5918	3.1358		(27a)					
150mm EPS B&B			40.7000	0.1300	5.2910		(28a)					
140mm Timber Frame	141.4700	15.2500	126.2200	0.1800	22.7196		(29a)					
Rooflight Stud Wall	5.4000		5.4000	0.1800	0.9720		(29a)					
400mm Mineral Wool	59.6000		59.6000	0.1300	7.7480		(30)					
Rooflight Sloping	2.1000	1.9700	0.1300	0.1300	0.0169		(30)					
Total net area of external elements Aum(A, m2)			249.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.4105		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.7237 (36)					
Total fabric heat loss						(33) + (36) =	78.1342 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.0639	Feb 47.7140	Mar 47.3710	Apr 45.7600	May 45.4586	Jun 44.0554	Jul 44.0554	Aug 43.7956	Sep 44.5959	Oct 45.4586	Nov 46.0683	Dec 46.7058 (38)
Heat transfer coeff	126.1980	125.8481	125.5051	123.8941	123.5927	122.1896	122.1896	121.9298	122.7301	123.5927	124.2025	124.8400 (39)
Average = Sum(39)m / 12 =												123.8927 (39)
HLP	Jan 1.3468	Feb 1.3431	Mar 1.3394	Apr 1.3222	May 1.3190	Jun 1.3041	Jul 1.3041	Aug 1.3013	Sep 1.3098	Oct 1.3190	Nov 1.3255	Dec 1.3323 (40)
HLP (average)												1.3222 (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												2.6731 (42)
Average daily hot water use (litres/day)												97.6851 (43)
Daily hot water use	Jan 107.4536	Feb 103.5462	Mar 99.6388	Apr 95.7314	May 91.8240	Jun 87.9165	Jul 87.9165	Aug 91.8240	Sep 95.7314	Oct 99.6388	Nov 103.5462	Dec 107.4536 (44)
Energy conte	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225 (45)
Energy content (annual)												Total = Sum(45)m = 1536.9663 (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:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	33.8620	29.6159	30.5610	26.6438	25.5654	22.0610	20.4427	23.4583	23.7385	27.6649	30.1984	32.7935 (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	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.7068	20.1680	16.4017	12.4172	9.2820	7.8362	8.4673	11.0061	14.7724	18.7570	21.8922	23.3379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.7226	248.2724	241.8469	228.1678	210.9004	194.6714	183.8295	181.2797	187.7052	201.3843	218.6517	234.8806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	(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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	(71)
Water heating gains (Table 5)	45.5134	44.0713	41.0766	37.0053	34.3620	30.6402	27.4768	31.5300	32.9701	37.1840	41.9422	44.0773	(72)
Total internal gains	377.0386	375.6075	362.4210	340.6860	317.6402	296.2437	282.8694	286.9116	298.5435	320.4211	345.5819	365.3917	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	4.9500	11.2829	0.6300	0.7000	0.7700	17.0687	(75)
Southwest	8.1800	36.7938	0.6300	0.7000	0.7700	91.9814	(79)
Southwest	1.9700	34.0172	0.6300	0.7000	1.0000	26.5978	(82)

Solar gains	135.6479	243.1875	362.0490	492.9733	589.2387	600.3644	572.4798	498.9163	407.4337	276.9574	164.7542	114.5733	(83)
Total gains	512.6865	618.7950	724.4700	833.6593	906.8789	896.6081	855.3492	785.8280	705.9772	597.3785	510.3361	479.9650	(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	51.5614	51.7047	51.8460	52.5202	52.6483	53.2528	53.2528	53.3663	53.0183	52.6483	52.3898	52.1223		
alpha	4.4374	4.4470	4.4564	4.5013	4.5099	4.5502	4.5502	4.5578	4.5346	4.5099	4.4927	4.4748		
util living area	0.9986	0.9964	0.9900	0.9671	0.9006	0.7597	0.5980	0.6618	0.8851	0.9829	0.9970	0.9989	(86)	
MIT	19.4561	19.6352	19.9317	20.3266	20.6765	20.9017	20.9745	20.9602	20.7838	20.3211	19.8174	19.4305	(87)	
Th 2	19.8043	19.8072	19.8101	19.8235	19.8260	19.8377	19.8377	19.8398	19.8331	19.8260	19.8209	19.8156	(88)	
util rest of house	0.9981	0.9952	0.9862	0.9534	0.8576	0.6617	0.4550	0.5191	0.8180	0.9735	0.9958	0.9986	(89)	
MIT 2	18.4062	18.5870	18.8838	19.2806	19.6057	19.7921	19.8314	19.8286	19.7103	19.2827	18.7799	18.3894	(90)	
Living area fraction									fLA = Living area / (4) =			0.0971	(91)	
MIT	18.5082	18.6888	18.9856	19.3822	19.7097	19.8999	19.9424	19.9385	19.8145	19.3835	18.8807	18.4905	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.5082	18.6888	18.9856	19.3822	19.7097	19.8999	19.9424	19.9385	19.8145	19.3835	18.8807	18.4905	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9934	0.9825	0.9467	0.8524	0.6676	0.4687	0.5323	0.8166	0.9684	0.9942	0.9979	(94)
Useful gains	511.2698	614.7199	711.7666	789.1917	773.0609	598.6203	400.8961	418.3241	576.5074	578.5099	507.4000	478.9789	(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	1793.0431	1735.2936	1567.0033	1298.6866	989.9381	647.5929	408.4052	431.4468	701.3439	1085.5773	1463.1885	1784.0269	(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	953.6393	753.0255	636.2961	366.8363	161.3567	0.0000	0.0000	0.0000	0.0000	377.2582	688.1677	970.9558	(98)
Space heating												4907.5356	(98)
Space heating per m2												(98) / (4) =	52.3750 (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	1148.5823	904.2031	926.6663	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8105	0.8826	0.8492	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	930.9197	798.0197	786.9247	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1123.0614	1074.0144	998.3095	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	138.3420	205.3401	157.2703	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												500.9524 (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	34.5855	51.3350	39.3176	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												125.2381 (107)
Space cooling per m2												1.3366 (108)
Energy for space heating												52.3750 (99)
Energy for space cooling												1.3366 (108)
Total												53.7116 (109)
Target Fabric Energy Efficiency (TFEE)												61.8 (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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.1800
Infiltration rate												0.2090 (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) =	0.2090 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2299	0.2142	0.2142	0.2038	0.2038	0.1933	0.1933	0.1829	0.1829	0.1986	0.1933	0.2038 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1800	7.3260	75.0000	3052.5000 (28a)
140mm Timber Frame	141.4700	15.2500	126.2200	0.1900	23.9818	9.0000	1135.9800 (29a)
Rooflight Stud Wall	5.4000		5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			249.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.9938		(33)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber FF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			18.0000	559.8000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7447.4700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.4821 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.1047 (36)
Total fabric heat loss						(33) + (36) =	84.0985 (37)

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

(38)m	Jan 39.0527	Feb 39.0527	Mar 39.0527	Apr 39.0527	May 39.0527	Jun 39.0527	Jul 39.0527	Aug 39.0527	Sep 39.0527	Oct 39.0527	Nov 39.0527	Dec 39.0527 (38)
Heat transfer coeff	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512 (39)
Average = Sum(39)m / 12 =												123.1512 (39)
HLP	Jan 1.3143	Feb 1.3143	Mar 1.3143	Apr 1.3143	May 1.3143	Jun 1.3143	Jul 1.3143	Aug 1.3143	Sep 1.3143	Oct 1.3143	Nov 1.3143	Dec 1.3143 (40)
HLP (average)												1.3143 (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	2.6731 (42)
Average daily hot water use (litres/day)	97.6851 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536	(44)
Energy conte	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225	(45)
Energy content (annual)	Total = Sum (45)m = 1536.9663												(45)
Distribution loss (46)m = 0.15 x (45)m	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484	(46)
Water storage loss:													
Store volume													120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.1100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(56)
If cylinder contains dedicated solar storage	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(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	201.1943	177.1634	185.6601	165.8765	162.1513	144.3103	138.0448	152.2359	152.2045	172.0316	182.6042	196.1663	(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	201.1943	177.1634	185.6601	165.8765	162.1513	144.3103	138.0448	152.2359	152.2045	172.0316	182.6042	196.1663	(64)
RHI water heating demand													2029.6433 (64)
Heat gains from water heating, kWh/month	86.4591	76.5757	81.2940	74.0849	73.4773	66.9141	65.4619	70.1804	69.5389	76.7625	79.6468	84.7873	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.7670	50.4200	41.0043	31.0429	23.2049	19.5906	21.1683	27.5154	36.9311	46.8925	54.7304	58.3448	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	366.7501	370.5558	360.9655	340.5489	314.7767	290.5544	274.3724	270.5667	280.1569	300.5735	326.3458	350.5681	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	(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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	(71)
Water heating gains (Table 5)	116.2085	113.9519	109.2661	102.8957	98.7598	92.9363	87.9864	94.3285	96.5819	103.1754	110.6206	113.9614	(72)
Total internal gains	649.8981	645.1002	621.4084	584.6600	546.9139	513.2537	493.6996	502.5830	523.8424	560.8139	601.8693	633.0467	(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
Northeast					4.9500	14.6176	0.7200	0.7000			0.7700			25.2724 (75)
Southwest					3.6600	45.1778	0.7200	0.7000			0.7700			57.7524 (79)
Southwest					4.5200	45.1778	0.7200	0.7000			0.7700			71.3227 (79)
Southwest					1.9700	43.5492	0.6300	0.7000			1.0000			34.0509 (82)
Solar gains	188.3983	287.5628	432.2753	593.8505	672.6864	752.0675	691.6416	627.9858	510.5196	349.0209	228.0865	150.6360 (83)		
Total gains	838.2964	932.6630	1053.6837	1178.5104	1219.6003	1265.3211	1185.3411	1130.5688	1034.3619	909.8348	829.9558	783.6827 (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)													
tau	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	
alpha	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	
util living area	0.8949	0.8694	0.8146	0.7254	0.6002	0.4326	0.3187	0.3320	0.5420	0.7436	0.8561	0.9048	(86)
MIT	18.6084	18.8580	19.3826	19.9793	20.5079	20.8351	20.9415	20.9366	20.7113	20.1181	19.2819	18.5494	(87)
Th 2	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	(88)
util rest of house	0.8812	0.8526	0.7904	0.6885	0.5425	0.3501	0.2142	0.2238	0.4608	0.6990	0.8342	0.8919	(89)
MIT 2	16.7371	17.0888	17.8243	18.6410	19.3317	19.7075	19.8046	19.8023	19.5877	18.8519	17.6994	16.6556	(90)
Living area fraction	fLA = Living area / (4) =												0.0971 (91)
MIT	16.9188	17.2606	17.9756	18.7710	19.4460	19.8170	19.9150	19.9124	19.6968	18.9749	17.8531	16.8395	(92)
Temperature adjustment													-0.1500
adjusted MIT	16.7688	17.1106	17.8256	18.6210	19.2960	19.6670	19.7650	19.7624	19.5468	18.8249	17.7031	16.6895	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8305	0.7999	0.7377	0.6434	0.5129	0.3377	0.2080	0.2172	0.4388	0.6522	0.7806	0.8426	(94)
Useful gains	696.2241	746.0065	777.3064	758.2408	625.5004	427.2937	246.5968	245.6003	453.8485	593.3725	647.8872	660.3092	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat loss rate W	1400.0852	1380.6005	1259.3006	1061.6867	763.0417	463.9142	254.3047	253.9899	522.9971	840.4940	1145.6878	1378.0049 (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												
Space heating	523.6726	426.4472	358.6037	218.4810	102.3308	0.0000	0.0000	0.0000	0.0000	183.8584	358.4165	533.9656 (98)
Space heating												2705.7759 (98)
RHI space heating demand												2706 (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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																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															4.1800		
Infiltration rate															0.2090 (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) =					0.2090 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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																	
	0.2665	0.2613	0.2560	0.2299	0.2247	0.1986	0.1986	0.1933	0.2090	0.2247	0.2351	0.2456 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5165	0.5113	0.5060	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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1800	7.3260	75.0000	3052.5000 (28a)
140mm Timber Frame	141.4700	15.2500	126.2200	0.1900	23.9818	9.0000	1135.9800 (29a)
Rooflight Stud Wall	5.4000		5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			249.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.9938		(33)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber FF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			18.0000	559.8000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7447.4700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.4821 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.1047 (36)
Total fabric heat loss						(33) + (36) =	84.0985 (37)

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

(38)m	Jan 40.3395	Feb 39.9314	Mar 39.5233	Apr 39.0527	May 39.0527	Jun 39.0527	Jul 39.0527	Aug 39.0527	Sep 39.0527	Oct 39.0527	Nov 39.0527	Dec 39.0527 (38)
Heat transfer coeff	124.4380	124.0299	123.6218	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512 (39)
Average = Sum(39)m / 12 =												123.3709 (39)
HLP	Jan 1.3280	Feb 1.3237	Mar 1.3193	Apr 1.3143	May 1.3143	Jun 1.3143	Jul 1.3143	Aug 1.3143	Sep 1.3143	Oct 1.3143	Nov 1.3143	Dec 1.3143 (40)
HLP (average)												1.3167 (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	2.6731 (42)
Average daily hot water use (litres/day)	97.6851 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536	(44)
Energy conte	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484	(46)
Water storage loss:													
Store volume													120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.1100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(56)
If cylinder contains dedicated solar storage	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(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	201.1943	177.1634	185.6601	165.8765	162.1513	144.3103	138.0448	152.2359	152.2045	172.0316	182.6042	196.1663	(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	201.1943	177.1634	185.6601	165.8765	162.1513	144.3103	138.0448	152.2359	152.2045	172.0316	182.6042	196.1663	(64)
Heat gains from water heating, kWh/month	86.4591	76.5757	81.2940	74.0849	73.4773	66.9141	65.4619	70.1804	69.5389	76.7625	79.6468	84.7873	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.7670	50.4200	41.0043	31.0429	23.2049	19.5906	21.1683	27.5154	36.9311	46.8925	54.7304	58.3448	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	366.7501	370.5558	360.9655	340.5489	314.7767	290.5544	274.3724	270.5667	280.1569	300.5735	326.3458	350.5681	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	(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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	(71)
Water heating gains (Table 5)	116.2085	113.9519	109.2661	102.8957	98.7598	92.9363	87.9864	94.3285	96.5819	103.1754	110.6206	113.9614	(72)
Total internal gains	649.8981	645.1002	621.4084	584.6600	546.9139	513.2537	493.6996	502.5830	523.8424	560.8139	601.8693	633.0467	(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			
Northeast					4.9500	11.2829	0.7200	0.7000	0.7700	19.5070 (75)			
Southwest					3.6600	36.7938	0.7200	0.7000	0.7700	47.0349 (79)			
Southwest					4.5200	36.7938	0.7200	0.7000	0.7700	58.0868 (79)			
Southwest					1.9700	34.0172	0.6300	0.7000	1.0000	26.5978 (82)			

Solar gains	151.2265	270.5335	401.6163	545.6051	651.4821	663.6054	632.8483	551.8929	451.4905	307.7606	183.5612	127.8099	(83)
Total gains	801.1245	915.6338	1023.0247	1130.2651	1198.3960	1176.8591	1126.5479	1054.4759	975.3328	868.5745	785.4306	760.8566	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	16.6247	16.6794	16.7344	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984
alpha	2.1083	2.1120	2.1156	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199
util living area	0.9131	0.8856	0.8413	0.7674	0.6640	0.5372	0.4221	0.4594	0.6316	0.7988	0.8862	0.9207 (86)
MIT	18.2636	18.5859	19.1003	19.7280	20.2859	20.6815	20.8645	20.8324	20.5226	19.8012	18.9254	18.2049 (87)
Th 2	19.8189	19.8223	19.8257	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296 (88)
util rest of house	0.9021	0.8713	0.8211	0.7366	0.6167	0.4658	0.3269	0.3639	0.5650	0.7652	0.8696	0.9105 (89)
MIT 2	16.2398	16.6980	17.4262	18.3004	19.0490	19.5442	19.7419	19.7146	19.3694	18.4239	17.1949	16.1602 (90)
Living area fraction												
MIT	16.4363	16.8814	17.5888	18.4390	19.1691	19.6546	19.8509	19.8232	19.4814	18.5576	17.3629	16.3588 (91)
Temperature adjustment												-0.1500
adjusted MIT	16.2863	16.7314	17.4388	18.2890	19.0191	19.5046	19.7009	19.6732	19.3314	18.4076	17.2129	16.2088 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	684.1674	750.4026	785.3545	776.6851	693.9082	522.3213	355.5024	368.9709	519.1545	619.5524	642.2808	657.5807	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Month fracti	1491.5549	1467.4423	1352.2701	1156.2702	901.3538	604.0104	381.8837	403.0940	644.2539	961.5193	1245.4183	1478.8993 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	600.6963	481.8507	421.7852	273.3012	154.3395	0.0000	0.0000	0.0000	0.0000	254.4234	434.2590	611.0610 (98)
Space heating												3231.7163 (98)
Space heating per m2												(98) / (4) = 34.4900 (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												3574.9074 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	600.6963	481.8507	421.7852	273.3012	154.3395	0.0000	0.0000	0.0000	0.0000	254.4234	434.2590	611.0610 (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)	664.4871	533.0207	466.5765	302.3244	170.7295	0.0000	0.0000	0.0000	0.0000	281.4418	480.3750	675.9524 (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	201.1943	177.1634	185.6601	165.8765	162.1513	144.3103	138.0448	152.2359	152.2045	172.0316	182.6042	196.1663 (64)
Efficiency of water heater	87.4542	87.2510	86.8368	86.0373	84.5821	79.7000	79.7000	79.7000	79.7000	85.7557	86.9447	79.7000 (216)
Fuel for water heating, kWh/month	230.0569	203.0503	213.8035	192.7961	191.7087	181.0668	173.2056	191.0111	190.9718	200.6067	210.0235	224.0777 (219)
Water heating fuel used												2402.3787 (219)
Annual totals kWh/year												
Space heating fuel - main system												3574.9074 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												66.2494 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												141.2494 (231)
Electricity for lighting (calculated in Appendix L)												401.0095 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1004 * 1.00) =										-530.1100		-530.1100 (233)
Total delivered energy for all uses												5989.4350 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3574.9074	3.4800	124.4068 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2402.3787	3.4800	83.6028 (247)
Mechanical ventilation fans	66.2494	13.1900	8.7383 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	401.0095	13.1900	52.8931 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-530.1100	13.1900	-69.9215 (252)
Total energy cost			329.6120 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.9981 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	86.0764
SAP rating (Section 12)		86 (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	3574.9074	0.2160	772.1800 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2402.3787	0.2160	518.9138 (264)
Space and water heating			1291.0938 (265)
Pumps and fans	141.2494	0.5190	73.3084 (267)
Energy for lighting	401.0095	0.5190	208.1239 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-530.1100	0.5190	-275.1271 (269)
Total kg/year			1297.3990 (272)
CO2 emissions per m2			13.8500 (273)
EI value			87.4656
EI rating			87 (274)
EI band			B

----- Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$	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	$3.48 / 0.8427 = 4.130$	stars = 4
Water heating environmental impact	$0.216 / 0.8427 = 0.2563$	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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.1800
Infiltration rate												0.2090 (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) =	0.2090 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2299	0.2142	0.2142	0.2038	0.2038	0.1933	0.1933	0.1829	0.1829	0.1986	0.1933	0.2038 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1800	7.3260	75.0000	3052.5000 (28a)
140mm Timber Frame	141.4700	15.2500	126.2200	0.1900	23.9818	9.0000	1135.9800 (29a)
Rooflight Stud Wall	5.4000		5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			249.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.9938		(33)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber FF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			18.0000	559.8000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7447.4700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.4821 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.1047 (36)
Total fabric heat loss							(33) + (36) = 84.0985 (37)

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

(38)m	Jan 39.0527	Feb 39.0527	Mar 39.0527	Apr 39.0527	May 39.0527	Jun 39.0527	Jul 39.0527	Aug 39.0527	Sep 39.0527	Oct 39.0527	Nov 39.0527	Dec 39.0527 (38)
Heat transfer coeff	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512 (39)
Average = Sum(39)m / 12 =												123.1512 (39)
HLP	Jan 1.3143	Feb 1.3143	Mar 1.3143	Apr 1.3143	May 1.3143	Jun 1.3143	Jul 1.3143	Aug 1.3143	Sep 1.3143	Oct 1.3143	Nov 1.3143	Dec 1.3143 (40)
HLP (average)												1.3143 (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	2.6731 (42)
Average daily hot water use (litres/day)	97.6851 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536	(44)
Energy conte	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225	(45)
Energy content (annual)	Total = Sum (45)m =												1536.9663 (45)
Distribution loss (46)m = 0.15 x (45)m	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484	(46)
Water storage loss:													
Store volume													120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.1100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(56)
If cylinder contains dedicated solar storage	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(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	201.1943	177.1634	185.6601	165.8765	162.1513	144.3103	138.0448	152.2359	152.2045	172.0316	182.6042	196.1663	(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	201.1943	177.1634	185.6601	165.8765	162.1513	144.3103	138.0448	152.2359	152.2045	172.0316	182.6042	196.1663	(64)
Heat gains from water heating, kWh/month	86.4591	76.5757	81.2940	74.0849	73.4773	66.9141	65.4619	70.1804	69.5389	76.7625	79.6468	84.7873	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.7670	50.4200	41.0043	31.0429	23.2049	19.5906	21.1683	27.5154	36.9311	46.8925	54.7304	58.3448	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	366.7501	370.5558	360.9655	340.5489	314.7767	290.5544	274.3724	270.5667	280.1569	300.5735	326.3458	350.5681	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	(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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	(71)
Water heating gains (Table 5)	116.2085	113.9519	109.2661	102.8957	98.7598	92.9363	87.9864	94.3285	96.5819	103.1754	110.6206	113.9614	(72)
Total internal gains	649.8981	645.1002	621.4084	584.6600	546.9139	513.2537	493.6996	502.5830	523.8424	560.8139	601.8693	633.0467	(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		
Northeast			4.9500	14.6176		0.7200		0.7000		0.7700		25.2724 (75)		
Southwest			3.6600	45.1778		0.7200		0.7000		0.7700		57.7524 (79)		
Southwest			4.5200	45.1778		0.7200		0.7000		0.7700		71.3227 (79)		
Southwest			1.9700	43.5492		0.6300		0.7000		1.0000		34.0509 (82)		
Solar gains			188.3983	287.5628	432.2753	593.8505	672.6864	752.0675	691.6416	627.9858	510.5196	349.0209	228.0865	150.6360 (83)
Total gains			838.2964	932.6630	1053.6837	1178.5104	1219.6003	1265.3211	1185.3411	1130.5688	1034.3619	909.8348	829.9558	783.6827 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	
alpha	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	
util living area	0.8949	0.8694	0.8146	0.7254	0.6002	0.4326	0.3187	0.3320	0.5420	0.7436	0.8561	0.9048	(86)
MIT	18.6084	18.8580	19.3826	19.9793	20.5079	20.8351	20.9415	20.9366	20.7113	20.1181	19.2819	18.5494	(87)
Th 2	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	(88)
util rest of house	0.8812	0.8526	0.7904	0.6885	0.5425	0.3501	0.2142	0.2238	0.4608	0.6990	0.8342	0.8919	(89)
MIT 2	16.7371	17.0888	17.8243	18.6410	19.3317	19.7075	19.8046	19.8023	19.5877	18.8519	17.6994	16.6556	(90)
Living area fraction	16.9188	17.2606	17.9756	18.7710	19.4460	19.8170	19.9150	19.9124	19.6968	18.9749	17.8531	16.8395	(91)
MIT	16.9188	17.2606	17.9756	18.7710	19.4460	19.8170	19.9150	19.9124	19.6968	18.9749	17.8531	16.8395	(92)
Temperature adjustment	16.7688	17.1106	17.8256	18.6210	19.2960	19.6670	19.7650	19.7624	19.5468	18.8249	17.7031	16.6895	(93)
adjusted MIT	16.7688	17.1106	17.8256	18.6210	19.2960	19.6670	19.7650	19.7624	19.5468	18.8249	17.7031	16.6895	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	696.2241	746.0065	777.3064	758.2408	625.5004	427.2937	246.5968	245.6003	453.8485	593.3725	647.8872	660.3092	(94)
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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Month fracti	1400.0852	1380.6005	1259.3006	1061.6867	763.0417	463.9142	254.3047	253.9899	522.9971	840.4940	1145.6878	1378.0049 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	523.6726	426.4472	358.6037	218.4810	102.3308	0.0000	0.0000	0.0000	0.0000	183.8584	358.4165	533.9656 (98)
Space heating												2705.7759 (98)
Space heating per m2											(98) / (4) =	28.8770 (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												2993.1149 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	523.6726	426.4472	358.6037	218.4810	102.3308	0.0000	0.0000	0.0000	0.0000	183.8584	358.4165	533.9656 (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)	579.2839	471.7337	396.6855	241.6826	113.1978	0.0000	0.0000	0.0000	0.0000	203.3832	396.4784	590.6699 (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	201.1943	177.1634	185.6601	165.8765	162.1513	144.3103	138.0448	152.2359	152.2045	172.0316	182.6042	196.1663 (64)
Efficiency of water heater	87.1524	86.9729	86.4413	85.4491	83.5251	79.7000	79.7000	79.7000	79.7000	84.8909	86.4813	79.7000 (216)
(217)m	87.1524	86.9729	86.4413	85.4491	83.5251	79.7000	79.7000	79.7000	79.7000	84.8909	86.4813	87.2528 (217)
Fuel for water heating, kWh/month	230.8534	203.6995	214.7818	194.1232	194.1349	181.0668	173.2056	191.0111	190.9718	202.6502	211.1488	224.8253 (219)
Water heating fuel used												2412.4724 (219)
Annual totals kWh/year												
Space heating fuel - main system												2993.1149 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												66.2494 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												141.2494 (231)
Electricity for lighting (calculated in Appendix L)												401.0095 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1115 * 1.00) =									-588.6659			-588.6659 (233)
Total delivered energy for all uses												5359.1802 (238)

10a. Fuel costs - using BEDF prices (533)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	2993.1149	10.2300	306.1957 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2412.4724	10.2300	246.7959 (247)
Mechanical ventilation fans	66.2494	36.7200	24.3268 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	401.0095	36.7200	147.2507 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-588.6659	36.7200	-216.1581 (252)
Total energy cost			638.9509 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	2993.1149	0.2160	646.5128 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2412.4724	0.2160	521.0940 (264)
Space and water heating			1167.6069 (265)
Pumps and fans	141.2494	0.5190	73.3084 (267)
Energy for lighting	401.0095	0.5190	208.1239 (268)
Energy saving/generation technologies			
PV Unit	-588.6659	0.5190	-305.5176 (269)
Total kg/year			1143.5216 (272)

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

Energy Primary energy factor Primary energy

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	2993.1149	1.2200	3651.6002 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2412.4724	1.2200	2943.2163 (264)
Space and water heating			6594.8165 (265)
Pumps and fans	141.2494	3.0700	433.6355 (267)
Energy for lighting	401.0095	3.0700	1231.0991 (268)
Energy saving/generation technologies			
PV Unit	-588.6659	3.0700	-1807.2044 (269)
Primary energy kWh/year			6452.3467 (272)
Primary energy kWh/m2/year			68.8618 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 87

(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	+ 1.5	-£ 112	-249 kg (21.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£112 2.65 kg/m²	B 88	B 90
Total Savings	£112 2.65 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
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	£199	£217	-£18
Mains gas	£656	£526	£130
Space heating	£461	£462	-£1
Water heating	£247	£134	£113
Lighting	£147	£147	£0
Generated (PV)	-£216	-£216	£0
Total cost of fuels	£639	£527	£112
Total cost of uses	£639	£527	£112
Delivered energy	57 kWh/m²	44 kWh/m²	13 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	12 kg/m²	10 kg/m²	3 kg/m²
Primary energy	69 kWh/m²	54 kWh/m²	15 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																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														4.1800			
Infiltration rate														0.2090 (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) =				0.2090 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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																	
	0.2665	0.2613	0.2560	0.2299	0.2247	0.1986	0.1986	0.1933	0.2090	0.2247	0.2351	0.2456 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																0.5000 (23a)	
Effective ac	0.5165	0.5113	0.5060	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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1800	7.3260	75.0000	3052.5000 (28a)
140mm Timber Frame	141.4700	15.2500	126.2200	0.1900	23.9818	9.0000	1135.9800 (29a)
Rooflight Stud Wall	5.4000		5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			249.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.9938		(33)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber FF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			18.0000	559.8000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7447.4700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.4821 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.1047 (36)
Total fabric heat loss						(33) + (36) =	84.0985 (37)

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

(38)m	Jan 40.3395	Feb 39.9314	Mar 39.5233	Apr 39.0527	May 39.0527	Jun 39.0527	Jul 39.0527	Aug 39.0527	Sep 39.0527	Oct 39.0527	Nov 39.0527	Dec 39.0527 (38)
Heat transfer coeff	124.4380	124.0299	123.6218	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512 (39)
Average = Sum(39)m / 12 =												123.3709 (39)
HLP	Jan 1.3280	Feb 1.3237	Mar 1.3193	Apr 1.3143	May 1.3143	Jun 1.3143	Jul 1.3143	Aug 1.3143	Sep 1.3143	Oct 1.3143	Nov 1.3143	Dec 1.3143 (40)
HLP (average)												1.3167 (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	2.6731 (42)
Average daily hot water use (litres/day)	97.6851 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536	(44)
Energy content (annual)	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225	(45)
Distribution loss	Total = Sum(45)m = 1536.9663 (45)												
(46)m = 0.15 x (45)m	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484	(46)
Water storage loss:													
Store volume	190.0000 (47)												
a) If manufacturer declared loss factor is known (kWh/day):	1.5079 (48)												
Temperature factor from Table 2b	0.5400 (49)												
Enter (49) or (54) in (55)	0.8143 (55)												
Total storage loss	25.2422	22.7994	25.2422	24.4279	25.2422	24.4279	25.2422	25.2422	24.4279	25.2422	24.4279	25.2422	(56)
If cylinder contains dedicated solar storage	15.2782	13.7996	15.2782	14.7853	15.2782	14.7853	15.2782	15.2782	14.7853	15.2782	14.7853	15.2782	(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	197.8911	174.1798	180.9611	155.9263	146.0538	128.5068	121.7146	136.8362	143.6049	167.3326	179.4075	192.8630	(62)
Aperture area of solar collector	3.0000 (H1)												
Zero-loss collector efficiency	0.7000 (H2)												
Collector heat loss coefficient	1.8000 (H3)												
Collector 2nd order heat loss coefficient	0.0050 (H3a)												
Collector effective heat loss coefficient	1.8063 (H3b)												
Collector performance ratio	2.5804 (H4)												
Annual solar radiation per m2	1079.5246 (H5)												
Overshading factor	0.8000 (H6)												
Solar energy available	1813.6014 (H7)												
Adjustment factor for showers	1.0000 (H7a)												
Solar-to-load ratio	1.1800 (H8)												
Utilisation factor	0.5715 (H9)												
Collector performance factor	0.8793 (H10)												
Dedicated solar storage volume	75.0000 (H11)												
Effective solar volume	109.5000 (H13)												
Daily hot water demand	97.6851 (H14)												
Volume ratio Veff/V	1.1209 (H15)												
Solar storage volume factor	1.0000 (H16)												
Solar input	-911.3654 (H17)												
Solar input	-26.4278	-44.1004	-75.1080	-100.6595	-124.3563	-122.2621	-120.6463	-105.4093	-82.5566	-56.3765	-31.3472	-22.1155	(63)
Output from w/h	Solar input (sum of months) = Sum(63)m = -911.3654 (63)												
	171.4633	130.0794	105.8532	55.2668	21.6975	6.2448	1.0683	31.4269	61.0483	110.9562	148.0604	170.7475	(64)
Heat gains from water heating, kWh/month	Total per year (kWh/year) = Sum(64)m = 1013.9125 (64)												
	83.8165	74.1888	77.5348	66.1247	60.5992	54.2714	52.3977	57.8607	62.6593	73.0033	77.0895	82.1447	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.7670	50.4200	41.0043	31.0429	23.2049	19.5906	21.1683	27.5154	36.9311	46.8925	54.7304	58.3448	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	366.7501	370.5558	360.9655	340.5489	314.7767	290.5544	274.3724	270.5667	280.1569	300.5735	326.3458	350.5681	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	(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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	(71)
Water heating gains (Table 5)	112.6566	110.4001	104.2134	91.8398	81.4506	75.3769	70.4271	77.7697	87.0268	98.1227	107.0687	110.4095	(72)
Total internal gains	646.3462	641.5483	616.3557	573.6041	529.6047	495.6943	476.1402	486.0242	514.2873	555.7612	598.3174	629.4949	(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				
Northeast				4.9500	11.2829	0.7200	0.7000	0.7700	19.5070 (75)				
Southwest				3.6600	36.7938	0.7200	0.7000	0.7700	47.0349 (79)				
Southwest				4.5200	36.7938	0.7200	0.7000	0.7700	58.0868 (79)				
Southwest				1.9700	34.0172	0.6300	0.7000	1.0000	26.5978 (82)				
Solar gains	151.2265	270.5335	401.6163	545.6051	651.4821	663.6054	632.8483	551.8929	451.4905	307.7606	183.5612	127.8099	(83)
Total gains	797.5727	912.0819	1017.9720	1119.2092	1181.0867	1159.2998	1108.9886	1037.9171	965.7777	863.5218	781.8787	757.3048	(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)													
tau	16.6247	16.6794	16.7344	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	
alpha	2.1083	2.1120	2.1156	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	
util living area	0.9138	0.8863	0.8424	0.7703	0.6690	0.5426	0.4273	0.4649	0.6351	0.8004	0.8870	0.9213	(86)
MIT	18.2580	18.5908	19.0939	19.7172	20.2745	20.6751	20.8611	20.8285	20.5172	19.7957	18.9202	18.1992	(87)
Th 2	19.8189	19.8223	19.8257	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	(88)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

util rest of house	0.9028	0.8721	0.8224	0.7396	0.6219	0.4710	0.3314	0.3687	0.5686	0.7669	0.8705	0.9112 (89)
MIT 2	16.2320	16.6909	17.4176	18.2863	19.0354	19.5378	19.7395	19.7116	19.3635	18.4168	17.1878	16.1522 (90)
Living area fraction									fLA = Living area / (4) =			0.0971 (91)
MIT	16.4287	16.8744	17.5804	18.4253	19.1557	19.6482	19.8485	19.8200	19.4756	18.5507	17.3560	16.3510 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.2787	16.7244	17.4304	18.2753	19.0057	19.4982	19.6985	19.6700	19.3256	18.4007	17.2060	16.2010 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8548	0.8204	0.7689	0.6900	0.5836	0.4485	0.3197	0.3543	0.5354	0.7149	0.8187	0.8651	(94)
Useful gains	681.7866	748.2427	782.7180	772.2360	689.2959	519.9368	354.5373	367.7670	517.0944	617.3342	640.1336	655.1339	(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													
	1490.6074	1466.5831	1351.2326	1154.5798	899.7082	603.2248	381.5805	402.7105	643.5356	960.6632	1244.5667	1477.9325	(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													
	601.7627	482.7247	422.9748	275.2875	156.5468	0.0000	0.0000	0.0000	0.0000	255.4368	435.1918	612.1621	(98)
Space heating													3242.0873 (98)
Space heating per m2											(98) / (4) =	34.6007	(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													3586.3797 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	601.7627	482.7247	422.9748	275.2875	156.5468	0.0000	0.0000	0.0000	0.0000	255.4368	435.1918	612.1621 (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)	665.6668	533.9875	467.8925	304.5216	173.1712	0.0000	0.0000	0.0000	0.0000	282.5628	481.4069	677.1705 (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	171.4633	130.0794	105.8532	55.2668	21.6975	6.2448	1.0683	31.4269	61.0483	110.9562	148.0604	170.7475 (64)	
Efficiency of water heater (217)m	87.7865	87.8952	88.0343	88.4154	88.9464	79.7000	79.7000	79.7000	79.7000	86.8682	87.4206	87.8284 (217)	
Fuel for water heating, kWh/month	195.3185	147.9938	120.2409	62.5081	24.3939	7.8354	1.3404	39.4315	76.5976	127.7293	169.3654	194.4103 (219)	
Water heating fuel used												1167.1651 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3586.3797 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													66.2494 (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													191.2494 (231)
Electricity for lighting (calculated in Appendix L)													401.0095 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.66 * 1004 * 1.00) =										-530.1100			-530.1100 (233)
Total delivered energy for all uses													4815.6937 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3586.3797	3.4800	124.8060 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1167.1651	3.4800	40.6173 (247)	
Mechanical ventilation fans	66.2494	13.1900	8.7383 (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	401.0095	13.1900	52.8931 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-530.1100	13.1900	-69.9215 (252)	
Total energy cost			293.6208 (255)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8891 (257)
SAP value		87.5968
SAP rating (Section 12)		88 (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	3586.3797	0.2160	774.6580 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1167.1651	0.2160	252.1077 (264)
Space and water heating			1026.7657 (265)
Pumps and fans	191.2494	0.5190	99.2584 (267)
Energy for lighting	401.0095	0.5190	208.1239 (268)
Energy saving/generation technologies			
PV Unit	-530.1100	0.5190	-275.1271 (269)
Total kg/year			1059.0209 (272)
CO2 emissions per m2			11.3000 (273)
EI value			89.7687
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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (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) =										0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											4.1800	
Infiltration rate											0.2090	(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) =	0.2090 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2299	0.2142	0.2142	0.2038	0.2038	0.1933	0.1933	0.1829	0.1829	0.1986	0.1933	0.2038 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1800	7.3260	75.0000	3052.5000 (28a)
140mm Timber Frame	141.4700	15.2500	126.2200	0.1900	23.9818	9.0000	1135.9800 (29a)
Rooflight Stud Wall			5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			249.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.9938		(33)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber FF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			18.0000	559.8000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7447.4700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.4821 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.1047 (36)
Total fabric heat loss							(33) + (36) = 84.0985 (37)

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

(38)m	Jan 39.0527	Feb 39.0527	Mar 39.0527	Apr 39.0527	May 39.0527	Jun 39.0527	Jul 39.0527	Aug 39.0527	Sep 39.0527	Oct 39.0527	Nov 39.0527	Dec 39.0527 (38)
Heat transfer coeff	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512 (39)
Average = Sum(39)m / 12 =												123.1512 (39)
HLP	Jan 1.3143	Feb 1.3143	Mar 1.3143	Apr 1.3143	May 1.3143	Jun 1.3143	Jul 1.3143	Aug 1.3143	Sep 1.3143	Oct 1.3143	Nov 1.3143	Dec 1.3143 (40)
HLP (average)												1.3143 (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	2.6731 (42)
Average daily hot water use (litres/day)	97.6851 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536	(44)
Energy conte	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225	(45)
Energy content (annual)	Total = Sum (45)m =												1536.9663 (45)
Distribution loss (46)m = 0.15 x (45)m	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484	(46)
Water storage loss:													
Store volume													190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5079 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8143 (55)
Total storage loss	25.2422	22.7994	25.2422	24.4279	25.2422	24.4279	25.2422	25.2422	24.4279	25.2422	24.4279	25.2422	(56)
If cylinder contains dedicated solar storage	15.2782	13.7996	15.2782	14.7853	15.2782	14.7853	15.2782	15.2782	14.7853	15.2782	14.7853	15.2782	(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	197.8911	174.1798	180.9611	155.9263	146.0538	128.5068	121.7146	136.8362	143.6049	167.3326	179.4075	192.8630	(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													1.3123 (H8)
Utilisation factor													0.5333 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													109.5000 (H13)
Daily hot water demand													97.6851 (H14)
Volume ratio Veff/V													1.1209 (H15)
Solar storage volume factor													1.0000 (H16)
Solar input													-945.7736 (H17)
Solar input	-31.0477	-44.1478	-75.8795	-102.3790	-119.6550	-129.0096	-122.8071	-111.9306	-87.4627	-60.1489	-36.7212	-24.5847	(63)
Output from w/h	166.8434	130.0320	105.0817	53.5473	26.3988	0.0000	0.0000	24.9056	56.1422	107.1838	142.6863	168.2784	(64)
Heat gains from water heating, kWh/month	83.8165	74.1888	77.5348	66.1247	60.5992	54.2714	52.3977	57.8607	62.6593	73.0033	77.0895	82.1447	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.7670	50.4200	41.0043	31.0429	23.2049	19.5906	21.1683	27.5154	36.9311	46.8925	54.7304	58.3448	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	366.7501	370.5558	360.9655	340.5489	314.7767	290.5544	274.3724	270.5667	280.1569	300.5735	326.3458	350.5681	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	(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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	(71)
Water heating gains (Table 5)	112.6566	110.4001	104.2134	91.8398	81.4506	75.3769	70.4271	77.7697	87.0268	98.1227	107.0687	110.4095	(72)
Total internal gains	646.3462	641.5483	616.3557	573.6041	529.6047	495.6943	476.1402	486.0242	514.2873	555.7612	598.3174	629.4949	(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
Northeast					4.9500	14.6176	0.7200	0.7000			0.7700			25.2724 (75)
Southwest					3.6600	45.1778	0.7200	0.7000			0.7700			57.7524 (79)
Southwest					4.5200	45.1778	0.7200	0.7000			0.7700			71.3227 (79)
Southwest					1.9700	43.5492	0.6300	0.7000			1.0000			34.0509 (82)
Solar gains	188.3983	287.5628	432.2753	593.8505	672.6864	752.0675	691.6416	627.9858	510.5196	349.0209	228.0865	150.6360 (83)		
Total gains	834.7445	929.1112	1048.6310	1167.4546	1202.2911	1247.7618	1167.7818	1114.0100	1024.8069	904.7821	826.4040	780.1309 (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)													
tau	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	
alpha	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	
util living area	0.8956	0.8702	0.8158	0.7284	0.6053	0.4373	0.3229	0.3363	0.5453	0.7453	0.8570	0.9055	(86)
MIT	18.6031	18.8531	19.3768	19.9700	20.4993	20.8315	20.9400	20.9350	20.7077	20.1136	19.2773	18.5440	(87)
Th 2	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	(88)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

util rest of house	0.8820	0.8534	0.7917	0.6917	0.5476	0.3542	0.2172	0.2269	0.4640	0.7008	0.8352	0.8927 (89)
MIT 2	16.7297	17.0821	17.8165	18.6294	19.3222	19.7047	19.8039	19.8015	19.5843	18.8464	17.6931	16.6480 (90)
Living area fraction									fLA = Living area / (4) =			0.0971 (91)
MIT	16.9117	17.2541	17.9681	18.7596	19.4365	19.8141	19.9142	19.9116	19.6934	18.9695	17.8469	16.8321 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.7617	17.1041	17.8181	18.6096	19.2865	19.6641	19.7642	19.7616	19.5434	18.8195	17.6969	16.6821 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8314	0.8007	0.7390	0.6462	0.5174	0.3415	0.2109	0.2202	0.4416	0.6538	0.7817	0.8435	(94)
Useful gains	693.9975	743.9682	774.9071	754.4420	622.0967	426.1404	246.2906	245.2739	452.5936	591.5811	645.9613	658.0055	(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													
	1399.2023	1379.7944	1258.3679	1060.2781	761.8766	463.5529	254.2080	253.8866	522.5825	839.8235	1144.9279	1377.0917	(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													
	524.6724	427.2752	359.6949	220.2020	103.9963	0.0000	0.0000	0.0000	0.0000	184.6923	359.2559	535.0001	(98)
Space heating												2714.7891	(98)
Space heating per m2											(98) / (4) =	28.9732	(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													3003.0852 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	524.6724	427.2752	359.6949	220.2020	103.9963	0.0000	0.0000	0.0000	0.0000	184.6923	359.2559	535.0001	(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)	580.3898	472.6495	397.8925	243.5863	115.0401	0.0000	0.0000	0.0000	0.0000	204.3057	397.4070	591.8143	(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	166.8434	130.0320	105.0817	53.5473	26.3988	0.0000	0.0000	24.9056	56.1422	107.1838	142.6863	168.2784	(64)
Efficiency of water heater (217)m	87.5637	87.6543	87.7369	88.0868	88.0079	79.7000	79.7000	79.7000	79.7000	86.1526	87.0768	87.5864	(216)
Fuel for water heating, kWh/month	190.5395	148.3464	119.7691	60.7892	29.9959	0.0000	0.0000	31.2492	70.4419	124.4116	163.8626	192.1284	(219)
Water heating fuel used												1131.5339	(219)
Annual totals kWh/year													
Space heating fuel - main system												3003.0852	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													66.2494 (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													191.2494 (231)
Electricity for lighting (calculated in Appendix L)													401.0095 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1115 * 1.00) =									-588.6659			-588.6659	(233)
Total delivered energy for all uses												4138.2120	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3003.0852	10.2300	307.2156	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1131.5339	10.2300	115.7559	(247)
Mechanical ventilation fans	66.2494	36.7200	24.3268	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	401.0095	36.7200	147.2507	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.6659	36.7200	-216.1581	(252)
Total energy cost			527.2909	(255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	3003.0852	0.2160	648.6664 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1131.5339	0.2160	244.4113 (264)
Space and water heating			893.0777 (265)
Pumps and fans	191.2494	0.5190	99.2584 (267)
Energy for lighting	401.0095	0.5190	208.1239 (268)
Energy saving/generation technologies			
PV Unit	-588.6659	0.5190	-305.5176 (269)
Total kg/year			894.9424 (272)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	3003.0852	1.2200	3663.7640 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1131.5339	1.2200	1380.4713 (264)
Space and water heating			5044.2353 (265)
Pumps and fans	191.2494	3.0700	587.1355 (267)
Energy for lighting	401.0095	3.0700	1231.0991 (268)
Energy saving/generation technologies			
PV Unit	-588.6659	3.0700	-1807.2044 (269)
Primary energy kWh/year			5055.2655 (272)
Primary energy kWh/m ² /year			53.9516 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	79.5 (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	312.42 (P1)
Transmission heat loss coefficient	84.10 (37)
Summer heat loss coefficient	396.52 (P2)

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

Solar shading	Z_blinds	Solar access	Z_overhangs	Z_summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
South West	1.000	1.00	1.000	1.000 (P8)

[Jul]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	4.9500	106.0502	0.7200	0.7000	0.9000	214.3050
South West	3.6600	127.3119	0.7200	0.7000	0.9000	190.2241
South West	4.5200	127.3119	0.7200	0.7000	0.9000	234.9215
South West	1.9700	218.3453	0.6300	0.7000	1.0000	170.7226

total: 810.1733

	Jun	Jul	Aug	
Solar gains	871	810	720	(P3)
Internal gains	510	491	500	
Total summer gains	1381	1301	1220	(P5)

Summer gain/loss ratio	3.48	3.28	3.08	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 79.5)	1.44	1.44	1.44	
Threshold temperature	20.33	22.02	21.82	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium