

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-165			Issued on Date	26/03/2024
Assessment Reference	As Built	Prop Type Ref	L Det As		
Property	5, Belmere Drive, Fair Oak, EASTLEIGH, SO50 7QS				
SAP Rating	85 B	DER	15.55	TER	19.21
Environmental	87 B	% DER<TER	19.07		
CO ₂ Emissions (t/year)	1.21	DFEE	53.02	TFEE	63.56
General Requirements Compliance	Pass	% DFEE<TFEE	16.59		
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) 19.21 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.55 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)63.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.0 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: 4.40 (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 East: 8.18 m², No overhang
Windows facing West: 4.95 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 0.64 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 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												4.4000
Infiltration rate												0.2200 (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) =	0.2200 (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												
	0.2805	0.2750	0.2695	0.2420	0.2365	0.2090	0.2090	0.2035	0.2200	0.2365	0.2475	0.2585 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5305	0.5250	0.5195	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5085 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.4349	41.0053	40.5758	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.7166 (38)
Heat transfer coeff	125.5334	125.1038	124.6742	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.8151 (39)
Average = Sum(39)m / 12 =												123.6947 (39)
HLP	Jan 1.3397	Feb 1.3352	Mar 1.3306	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 1.3214 (40)
HLP (average)												1.3201 (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 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	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
East				3.6600		19.6403		0.7200		0.7000		0.7700		25.1068 (76)
West				4.9500		19.6403		0.7200		0.7000		0.7700		33.9560 (80)
East				4.5200		19.6403		0.7200		0.7000		0.7700		31.0063 (76)
East				1.9700		26.6635		0.6300		0.7000		1.0000		20.8480 (82)
Solar gains	110.9171	218.6832	364.2982	537.7128	664.6035	682.8101	649.0492	553.7754	425.7886	260.5866	138.6088	91.0148		(83)
Total gains	561.6508	667.1713	797.9088	947.2893	1049.6414	1044.3498	995.4283	906.4855	790.9439	649.9991	555.8691	529.2906		(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	16.4796	16.5362	16.5932	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7083
alpha	2.0986	2.1024	2.1062	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1139
util living area	0.9531	0.9323	0.8917	0.8157	0.7086	0.5803	0.4640	0.5125	0.7035	0.8670	0.9359	0.9581 (86)
MIT	17.8412	18.1783	18.7743	19.5347	20.1798	20.6279	20.8366	20.7918	20.4009	19.5351	18.5662	17.7956 (87)
Th 2	19.8098	19.8134	19.8170	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8241 (88)
util rest of house	0.9465	0.9229	0.8763	0.7887	0.6633	0.5077	0.3632	0.4116	0.6400	0.8413	0.9254	0.9522 (89)
MIT 2	15.6376	16.1219	16.9734	18.0461	18.9213	19.4908	19.7217	19.6830	19.2356	18.0730	16.6927	15.5759 (90)
Living area fraction									fLA = Living area / (4) =			0.0971 (91)
MIT	15.8516	16.3216	17.1483	18.1906	19.0436	19.6012	19.8300	19.7907	19.3488	18.2150	16.8746	15.7915 (92)
Temperature adjustment												-0.1500
adjusted MIT	15.7016	16.1716	16.9983	18.0406	18.8936	19.4512	19.6800	19.6407	19.1988	18.0650	16.7246	15.6415 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	510.9400	586.3627	658.0044	697.1243	651.1303	502.5756	347.3686	356.5617	473.3483	511.8346	490.4166	485.8949	(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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Month fracti	1431.2799	1410.1184	1308.8720	1125.6796	885.8962	597.4312	379.3077	399.0956	627.9235	919.3285	1185.2824	1416.6267 (97)
Space heating	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	684.7329	553.5638	484.2455	308.5598	174.6658	0.0000	0.0000	0.0000	0.0000	303.1755	500.3034	692.4645 (98)
Space heating												3701.7112 (98)
Space heating per m2											(98) / (4) =	39.5060 (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												4094.8133 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	684.7329	553.5638	484.2455	308.5598	174.6658	0.0000	0.0000	0.0000	0.0000	303.1755	500.3034	692.4645 (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)	757.4479	612.3494	535.6698	341.3273	193.2144	0.0000	0.0000	0.0000	0.0000	335.3711	553.4330	766.0005 (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	87.7253	87.5503	87.1571	86.3470	84.9119	79.7000	79.7000	79.7000	79.7000	86.2101	87.2673	79.7000 (216)
(217)m	87.7253	87.5503	87.1571	86.3470	84.9119	79.7000	79.7000	79.7000	79.7000	86.2101	87.2673	87.7980 (217)
Fuel for water heating, kWh/month	229.3457	202.3562	213.0178	192.1046	190.9642	181.0668	173.2056	191.0111	190.9718	199.5494	209.2471	223.4292 (219)
Water heating fuel used												2396.2694 (219)
Annual totals kWh/year												
Space heating fuel - main system												4094.8133 (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 * 0.64 * 853 * 1.00) =									-436.7513			-436.7513 (233)
Total delivered energy for all uses												6596.5903 (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	4094.8133	0.2160	884.4797 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2396.2694	0.2160	517.5942 (264)
Space and water heating			1402.0739 (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	-436.7513	0.5190	-226.6739 (269)
Total CO2, kg/year			1456.8323 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.5500 (273)

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

DER			15.5500 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			33.0447 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			33.0447 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		(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 * 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:												

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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	
East				8.1800	19.6403			0.6300	0.7000		0.7700	49.0990 (76)
West				4.9500	19.6403			0.6300	0.7000		0.7700	29.7115 (80)
East				1.9700	26.6635			0.6300	0.7000		1.0000	20.8480 (82)
Solar gains	99.6585	196.6589	328.0274	484.8139	599.7739	616.4455	585.8674	499.5031	383.6041	234.4529	124.5706	81.7563 (83)
Total gains	552.4559	647.2108	763.7017	896.4541	986.8756	980.0490	934.3102	854.2770	750.8231	625.9292	543.8946	522.0958 (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												
	0.9981	0.9957	0.9878	0.9578	0.8749	0.7171	0.5547	0.6199	0.8649	0.9796	0.9962	0.9985 (86)
MIT	19.4943	19.6622	19.9677	20.3775	20.7219	20.9228	20.9811	20.9694	20.8077	20.3464	19.8495	19.4711 (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												
	0.9974	0.9942	0.9832	0.9410	0.8256	0.6170	0.4185	0.4810	0.7918	0.9687	0.9945	0.9980 (89)
MIT 2	17.8123	18.0593	18.5051	19.0979	19.5560	19.7873	19.8311	19.8277	19.6774	19.0655	18.3428	17.7861 (90)
Living area fraction												
MIT	17.9756	18.2149	18.6471	19.2221	19.6692	19.8976	19.9428	19.9386	19.7872	19.1899	18.4891	17.9497 (91)
Temperature adjustment												0.0971 (91)
adjusted MIT	17.9756	18.2149	18.6471	19.2221	19.6692	19.8976	19.9428	19.9386	19.7872	19.1899	18.4891	17.9497 (92)
												0.0000
												17.9497 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9957	0.9910	0.9765	0.9296	0.8177	0.6227	0.4314	0.4937	0.7882	0.9599	0.9916	0.9966 (94)
Useful gains	550.0548	641.3996	745.7823	833.3539	806.9720	610.3197	403.0712	421.7461	591.8035	600.8551	539.3016	520.3261 (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												
1725.8380	1675.6584	1524.5250	1278.8518	984.9407	647.3112	408.4518	431.4567	697.9899	1061.6538	1414.5583	1716.5135	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh												
874.7827	695.0219	579.3846	320.7585	132.4087	0.0000	0.0000	0.0000	0.0000	342.8343	630.1848	889.9634	(98)
Space heating												4465.3388 (98)
Space heating per m2												(98) / (4) = 47.6557 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4775.7634	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	874.7827	695.0219	579.3846	320.7585	132.4087	0.0000	0.0000	0.0000	0.0000	342.8343	630.1848	889.9634	(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)	935.5965	743.3389	619.6626	343.0572	141.6135	0.0000	0.0000	0.0000	0.0000	366.6677	673.9944	951.8325	(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	88.2697	88.0823	87.6264	86.5167	84.2486	79.8000	79.8000	79.8000	79.8000	86.5918	87.8333	88.3434	(216)	
Fuel for water heating, kWh/month	230.1056	203.1020	214.0672	193.8747	194.7459	183.1675	175.3936	193.1769	193.0600	200.8861	210.0133	224.2221	(219)	
Water heating fuel used												2415.8151	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4775.7634	(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													7667.5880	(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	4775.7634	0.2160	1031.5649 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2415.8151	0.2160	521.8161 (264)
Space and water heating			1553.3810 (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			1800.4299 (272)
Emissions per m2 for space and water heating			16.5782 (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) = (16.5782 * 1.00) + 2.2212 + 0.4154, rounded to 2 d.p.			19.2100 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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 * 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					4.4000
Infiltration rate					0.3468 (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) =	0.3468 (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	0.4421	0.4334	0.4248	0.3814	0.3728	0.3294	0.3294	0.3207	0.3468	0.3728	0.3901	0.4074 (22b)
Effective ac	0.5977	0.5939	0.5902	0.5727	0.5695	0.5543	0.5543	0.5514	0.5601	0.5695	0.5761	0.5830 (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	46.6859	46.3895	46.0990	44.7343	44.4790	43.2904	43.2904	43.0703	43.7483	44.4790	44.9955	45.5355 (38)
Average = Sum(39)m / 12 =	130.7844	130.4880	130.1975	128.8328	128.5775	127.3889	127.3889	127.1688	127.8468	128.5775	129.0940	129.6340 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3958	1.3926	1.3895	1.3750	1.3722	1.3595	1.3595	1.3572	1.3644	1.3722	1.3777	1.3835 (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												

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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	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					3.6600	19.6403	0.7200	0.7000	0.7700		25.1068 (76)	
West					4.9500	19.6403	0.7200	0.7000	0.7700		33.9560 (80)	
East					4.5200	19.6403	0.7200	0.7000	0.7700		31.0063 (76)	
East					1.9700	26.6635	0.6300	0.7000	1.0000		20.8486 (82)	
Solar gains	110.9171	218.6832	364.2982	537.7128	664.6035	682.8101	649.0492	553.7754	425.7886	260.5866	138.6088	91.0148 (83)
Total gains	487.9558	594.2907	726.7192	878.3988	982.2437	979.0538	931.9186	840.6870	724.3321	581.0077	484.1907	456.4065 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	15.2235	15.2580	15.2921	15.4541	15.4848	15.6292	15.6292	15.6563	15.5733	15.4848	15.4228	15.3586	
alpha	2.0149	2.0172	2.0195	2.0303	2.0323	2.0419	2.0419	2.0438	2.0382	2.0323	2.0282	2.0239	
util living area	0.9617	0.9426	0.9052	0.8347	0.7335	0.6082	0.4936	0.5449	0.7343	0.8871	0.9478	0.9663	(86)
MIT	17.5368	17.8848	18.5101	19.3194	20.0315	20.5500	20.7942	20.7400	20.2842	19.3255	18.2845	17.4761	(87)
Th 2	19.7666	19.7690	19.7714	19.7826	19.7847	19.7945	19.7945	19.7963	19.7907	19.7847	19.7804	19.7760	(88)
util rest of house	0.9562	0.9344	0.8913	0.8092	0.6890	0.5345	0.3874	0.4400	0.6723	0.8640	0.9389	0.9614	(89)
MIT 2	16.6237	16.9687	17.5847	18.3756	19.0456	19.5111	19.7005	19.6692	19.2991	18.4013	17.3763	16.5695	(90)
Living area fraction	16.7124	17.0577	17.6746	18.4672	19.1414	19.6120	19.8067	19.7732	19.3948	18.4910	17.4645	16.6576	(92)
MIT	16.7124	17.0577	17.6746	18.4672	19.1414	19.6120	19.8067	19.7732	19.3948	18.4910	17.4645	16.6576	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.7124	17.0577	17.6746	18.4672	19.1414	19.6120	19.8067	19.7732	19.3948	18.4910	17.4645	16.6576	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	456.8373	540.2130	624.6384	680.6871	649.6384	510.9605	362.1421	367.9924	469.2994	482.9562	442.9739	430.4646	(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	1623.3499	1586.4343	1454.9023	1232.5751	956.7903	638.4723	408.4996	428.9708	676.9245	1014.6070	1337.9983	1614.9235	(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	867.8853	703.0608	617.7163	397.3593	228.5210	0.0000	0.0000	0.0000	0.0000	395.5482	644.4176	881.2374	(98)
Space heating												4735.7460	(98)
Space heating per m2												50.5416	(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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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	1197.4560	942.6782	966.4832	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6776	0.7391	0.7031	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	811.4116	696.7358	679.5343	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1220.4030	1164.5756	1063.8626	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	294.4738	348.0728	285.9403	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			928.4869	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	73.6184	87.0182	71.4851	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												232.1217	(107)
Energy for space heating												2.4773	(108)
Energy for space cooling												50.5416	(99)
Total												2.4773	(108)
Dwelling Fabric Energy Efficiency (DFEE)												53.0189	(109)
												53.0	(109)

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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:												

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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	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	8.1800	19.6403	0.6300	0.7000	0.7700	49.0990	(76)
West	4.9500	19.6403	0.6300	0.7000	0.7700	29.7115	(80)
East	1.9700	26.6635	0.6300	0.7000	1.0000	20.8480	(82)

Solar gains	99.6585	196.6589	328.0274	484.8139	599.7739	616.4455	585.8674	499.5031	383.6041	234.4529	124.5706	81.7563	(83)
Total gains	476.6971	572.2664	690.4484	825.4999	917.4141	912.6892	868.7368	786.4148	682.1476	554.8740	470.1525	447.1479	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	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	0.9989	0.9974	0.9917	0.9682	0.8973	0.7514	0.5903	0.6615	0.8955	0.9870	0.9979	0.9992	(86)	
MIT	19.4215	19.5908	19.9002	20.3198	20.6828	20.9062	20.9758	20.9603	20.7702	20.2827	19.7789	19.3989	(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	0.9986	0.9965	0.9885	0.9549	0.8535	0.6528	0.4484	0.5187	0.8318	0.9797	0.9970	0.9989	(89)	
MIT 2	18.3717	18.5429	18.8528	19.2743	19.6108	19.7946	19.8317	19.8286	19.7005	19.2458	18.7416	18.3578	(90)	
Living area fraction										fLA = Living area / (4) =		0.0971	(91)	
MIT	18.4736	18.6447	18.9545	19.3758	19.7149	19.9025	19.9428	19.9385	19.8044	19.3465	18.8423	18.4589	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.4736	18.6447	18.9545	19.3758	19.7149	19.9025	19.9428	19.9385	19.8044	19.3465	18.8423	18.4589	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9951	0.9852	0.9482	0.8484	0.6590	0.4620	0.5320	0.8298	0.9753	0.9958	0.9985	(94)
Useful gains	475.7072	569.4614	680.2236	782.7654	778.3693	601.4402	401.3700	418.3626	566.0398	541.1839	468.1787	446.4558	(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	1788.6850	1729.7390	1563.1097	1297.8936	990.5808	647.9142	408.4600	431.4512	700.0957	1081.0019	1458.4269	1780.0773	(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	976.8555	779.7065	656.8673	370.8924	157.8854	0.0000	0.0000	0.0000	0.0000	401.6246	712.9787	992.2144	(98)
Space heating												5049.0248	(98)
Space heating per m2												53.8850	(99)
										(98) / (4) =			

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	0.8178	0.8874	0.8500	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	939.2684	802.3779	787.6532	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1142.8340	1090.7268	1000.4275	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)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	146.5672	214.5316	158.3041	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												519.4029 (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	36.6418	53.6329	39.5760	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												129.8507 (107)
Space cooling per m2												1.3858 (108)
Energy for space heating												53.8850 (99)
Energy for space cooling												1.3858 (108)
Total												55.2708 (109)
Target Fabric Energy Efficiency (TFEE)												63.6 (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	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															4.4000		
Infiltration rate															0.2200 (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) =					0.2200 (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																	
	0.2420	0.2255	0.2255	0.2145	0.2145	0.2035	0.2035	0.1925	0.1925	0.2090	0.2035	0.2145 (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
East				3.6600	25.1925	0.7200	0.7000			0.7700			32.2045 (76)
West				4.9500	25.1925	0.7200	0.7000			0.7700			43.5553 (80)
East				4.5200	25.1925	0.7200	0.7000			0.7700			39.7717 (76)
East				1.9700	34.6424	0.6300	0.7000			1.0000			27.0867 (82)

Solar gains	142.6182	239.2173	400.6577	592.3733	690.0394	776.2467	712.2715	635.8502	490.0971	303.4334	177.6478	110.7661	(83)
Total gains	792.5163	884.3175	1022.0661	1177.0333	1236.9533	1289.5004	1205.9711	1138.4333	1013.9394	864.2472	779.5171	743.8128	(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	0.9040	0.8797	0.8223	0.7258	0.5951	0.4262	0.3139	0.3300	0.5492	0.7592	0.8691	0.9126	(86)
MIT	18.5394	18.7907	19.3460	19.9780	20.5164	20.8398	20.9432	20.9374	20.7036	20.0764	19.2144	18.4877	(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	0.8912	0.8639	0.7987	0.6890	0.5374	0.3445	0.2107	0.2224	0.4676	0.7158	0.8485	0.9006	(89)
MIT 2	16.6407	16.9957	17.7751	18.6395	19.3411	19.7113	19.8054	19.8026	19.5804	18.8004	17.6075	16.5689	(90)
Living area fraction	fLA = Living area / (4) =												0.0971 (91)
MIT	16.8251	17.1700	17.9277	18.7695	19.4552	19.8209	19.9159	19.9128	19.6895	18.9243	17.7635	16.7553	(92)
Temperature adjustment													-0.1500
adjusted MIT	16.6751	17.0200	17.7777	18.6195	19.3052	19.6709	19.7659	19.7628	19.5395	18.7743	17.6135	16.6053	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	667.1013	717.8148	762.1312	757.7356	628.8365	428.8253	246.9418	245.7511	451.1399	576.8028	619.9750	634.1195	(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	1388.5385	1369.4412	1253.3935	1061.4995	764.1801	464.3929	254.4135	254.0376	522.1012	834.2662	1134.6559	1367.6272 (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	536.7493	437.8929	365.4991	218.7100	100.6957	0.0000	0.0000	0.0000	0.0000	191.5528	370.5703	545.7298 (98)
Space heating												2767.3999 (98)
RHI space heating demand												2767 (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 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											4.4000	
Infiltration rate											0.2200 (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) =	0.2200 (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	0.2805	0.2750	0.2695	0.2420	0.2365	0.2090	0.2090	0.2035	0.2200	0.2365	0.2475	0.2585 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5305	0.5250	0.5195	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5085 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	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, m2)			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/m2K							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)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.4349	41.0053	40.5758	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.7166 (38)
Heat transfer coeff	125.5334	125.1038	124.6742	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.8151 (39)
Average = Sum(39)m / 12 =												123.6947 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3397	1.3352	1.3306	1.3143	1.3143	1.3143	1.3143	1.3143	1.3143	1.3143	1.3143	1.3214 (40)
HLP (average)												1.3201 (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			
East					3.6600	19.6403	0.7200	0.7000	0.7700	25.1068 (76)			
West					4.9500	19.6403	0.7200	0.7000	0.7700	33.9560 (80)			
East					4.5200	19.6403	0.7200	0.7000	0.7700	31.0063 (76)			
East					1.9700	26.6635	0.6300	0.7000	1.0000	20.8480 (82)			
Solar gains	110.9171	218.6832	364.2982	537.7128	664.6035	682.8101	649.0492	553.7754	425.7886	260.5866	138.6088	91.0148	(83)
Total gains	760.8152	863.7834	985.7066	1122.3728	1211.5174	1196.0637	1142.7488	1056.3584	949.6309	821.4005	740.4781	724.0616	(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	16.4796	16.5362	16.5932	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7083
alpha	2.0986	2.1024	2.1062	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1139
util living area	0.9206	0.8962	0.8505	0.7694	0.6602	0.5314	0.4174	0.4588	0.6410	0.8135	0.8964	0.9272 (86)
MIT	18.1754	18.4866	19.0318	19.7203	20.2944	20.6884	20.8674	20.8329	20.5077	19.7488	18.8594	18.1302 (87)
Th 2	19.8098	19.8134	19.8170	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8241 (88)
util rest of house	0.9103	0.8829	0.8311	0.7388	0.6128	0.4602	0.3229	0.3634	0.5746	0.7813	0.8809	0.9178 (89)
MIT 2	16.1122	16.5557	17.3284	18.2904	19.0590	19.5509	19.7440	19.7149	19.3534	18.3558	17.1034	16.0526 (90)
Living area fraction	16.3125	16.7432	17.4938	18.4292	19.1790	19.6614	19.8531	19.8235	19.4655	18.4911	17.2739	16.2544 (92)
MIT	16.3125	16.7432	17.4938	18.4292	19.1790	19.6614	19.8531	19.8235	19.4655	18.4911	17.2739	16.2544 (91)
Temperature adjustment												-0.1500
adjusted MIT	16.1625	16.5932	17.3438	18.2792	19.0290	19.5114	19.7031	19.6735	19.3155	18.3411	17.1239	16.1044 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8635	0.8319	0.7773	0.6892	0.5756	0.4388	0.3118	0.3494	0.5408	0.7285	0.8301	0.8729	(94)
Useful gains	656.9465	718.6080	766.1561	773.5135	697.3449	524.8556	356.3629	369.1052	513.5426	598.3746	614.6591	632.0159	(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													

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Month fracti	1489.1440	1462.8636	1351.9417	1155.0654	902.5765	604.8427	382.1536	403.1367	642.2934	953.3197	1234.4592	1473.9381 (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	619.1549	500.1398	435.8245	274.7174	152.6923	0.0000	0.0000	0.0000	0.0000	264.0792	446.2561	626.3901 (98)
Space heating												3319.2542 (98)
Space heating per m2											(98) / (4) =	35.4243 (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												3671.7413 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	619.1549	500.1398	435.8245	274.7174	152.6923	0.0000	0.0000	0.0000	0.0000	264.0792	446.2561	626.3901 (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)	684.9058	553.2520	482.1067	303.8909	168.9074	0.0000	0.0000	0.0000	0.0000	292.1230	493.6461	692.9094 (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	87.5183	87.3331	86.9142	86.0506	84.5537	79.7000	79.7000	79.7000	79.7000	85.8533	87.0081	79.7000 (216)
Fuel for water heating, kWh/month	229.8882	202.8593	213.6131	192.7662	191.7733	181.0668	173.2056	191.0111	190.9718	200.3785	209.8703	223.9458 (219)
Water heating fuel used												2401.3500 (219)
Annual totals kWh/year												
Space heating fuel - main system												3671.7413 (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 * 0.64 * 853 * 1.00) =									-436.7513			-436.7513 (233)
Total delivered energy for all uses												6178.5989 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	3671.7413	3.4800	127.7766 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2401.3500	3.4800	83.5670 (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	-436.7513	13.1900	-57.6075 (252)
Total energy cost			345.2600 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0455 (257)
SAP value		85.4154
SAP rating (Section 12)		85 (258)
SAP band		B

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	3671.7413	0.2160	793.0961 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2401.3500	0.2160	518.6916 (264)
Space and water heating			1311.7877 (265)
Pumps and fans	141.2494	0.5190	73.3084 (267)
Energy for lighting	401.0095	0.5190	208.1239 (268)

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Energy saving/generation technologies			
PV Unit	-436.7513	0.5190	-226.6739 (269)
Total kg/year			1366.5461 (272)
CO2 emissions per m2			14.5800 (273)
EI value			86.7976
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	$3.48 / 0.8430 = 4.128$	stars = 4
Water heating environmental impact	$0.216 / 0.8430 = 0.2562$	stars = 4

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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) =																Air changes per hour			
Pressure test																0.0000 / (5) =		0.0000 (8)	
Measured/design AP50																Yes			
Infiltration rate																		4.4000	
Number of sides sheltered																		0.2200 (18)	
																		0 (19)	
Shelter factor																(20) = 1 - [0.075 x (19)] =		1.0000 (20)	
Infiltration rate adjusted to include shelter factor																(21) = (18) x (20) =		0.2200 (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																			
	0.2420	0.2255	0.2255	0.2145	0.2145	0.2035	0.2035	0.1925	0.1925	0.2090	0.2035	0.2145	(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			
East				3.6600	25.1925	0.7200	0.7000	0.7700	32.2045 (76)			
West				4.9500	25.1925	0.7200	0.7000	0.7700	43.5553 (80)			
East				4.5200	25.1925	0.7200	0.7000	0.7700	39.7717 (76)			
East				1.9700	34.6424	0.6300	0.7000	1.0000	27.0867 (82)			
Solar gains	142.6182	239.2173	400.6577	592.3733	690.0394	776.2467	712.2715	635.8502	490.0971	303.4334	177.6478	110.7661 (83)
Total gains	792.5163	884.3175	1022.0661	1177.0333	1236.9533	1289.5004	1205.9711	1138.4333	1013.9394	864.2472	779.5171	743.8128 (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	0.9040	0.8797	0.8223	0.7258	0.5951	0.4262	0.3139	0.3300	0.5492	0.7592	0.8691	0.9126	(86)
MIT	18.5394	18.7907	19.3460	19.9780	20.5164	20.8398	20.9432	20.9374	20.7036	20.0764	19.2144	18.4877	(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	0.8912	0.8639	0.7987	0.6890	0.5374	0.3445	0.2107	0.2224	0.4676	0.7158	0.8485	0.9006	(89)
MIT 2	16.6407	16.9957	17.7751	18.6395	19.3411	19.7113	19.8054	19.8026	19.5804	18.8004	17.6075	16.5689	(90)
Living area fraction	16.8251	17.1700	17.9277	18.7695	19.4552	19.8209	19.9159	19.9128	19.6895	18.9243	17.7635	16.7553	(91)
Temperature adjustment	16.6751	17.0200	17.7777	18.6195	19.3052	19.6709	19.7659	19.7628	19.5395	18.7743	17.6135	16.6053	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8418	0.8117	0.7457	0.6438	0.5084	0.3326	0.2048	0.2159	0.4449	0.6674	0.7953	0.8525	(94)
Useful gains	667.1013	717.8148	762.1312	757.7356	628.8365	428.8253	246.9418	245.7511	451.1399	576.8028	619.9750	634.1195	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Month fracti	1388.5385	1369.4412	1253.3935	1061.4995	764.1801	464.3929	254.4135	254.0376	522.1012	834.2662	1134.6559	1367.6272 (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	536.7493	437.8929	365.4991	218.7100	100.6957	0.0000	0.0000	0.0000	0.0000	191.5528	370.5703	545.7298 (98)
Space heating												2767.3999 (98)
Space heating per m2											(98) / (4) =	29.5347 (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												3061.2831 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	536.7493	437.8929	365.4991	218.7100	100.6957	0.0000	0.0000	0.0000	0.0000	191.5528	370.5703	545.7298 (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)	593.7493	484.3948	404.3132	241.9359	111.3890	0.0000	0.0000	0.0000	0.0000	211.8947	409.9229	603.6834 (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	87.2079	87.0343	86.4887	85.4519	83.4856	79.7000	79.7000	79.7000	79.7000	85.0005	86.5637	79.7000 (216)
(217)m	87.2079	87.0343	86.4887	85.4519	83.4856	79.7000	79.7000	79.7000	79.7000	85.0005	86.5637	87.3010 (217)
Fuel for water heating, kWh/month	230.7065	203.5558	214.6641	194.1169	194.2267	181.0668	173.2056	191.0111	190.9718	202.3889	210.9477	224.7011 (219)
Water heating fuel used												2411.5630 (219)
Annual totals kWh/year												
Space heating fuel - main system												3061.2831 (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 * 0.64 * 961 * 1.00) =									-491.9253			-491.9253 (233)
Total delivered energy for all uses												5523.1796 (238)

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

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	3061.2831	7.6100	232.9636 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2411.5630	7.6100	183.5199 (247)
Mechanical ventilation fans	66.2494	31.0800	20.5903 (249)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	401.0095	31.0800	124.6337 (250)
Additional standing charges			105.0000 (251)
Energy saving/generation technologies			
PV Unit	-491.9253	31.0800	-152.8904 (252)
Total energy cost			537.1272 (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	3061.2831	0.2160	661.2371 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2411.5630	0.2160	520.8976 (264)
Space and water heating			1182.1348 (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	-491.9253	0.5190	-255.3093 (269)
Total kg/year			1208.2578 (272)

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

Energy Primary energy factor Primary energy

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

	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	3061.2831	1.2200	3734.7653 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2411.5630	1.2200	2942.1069 (264)
Space and water heating			6676.8722 (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	-491.9253	3.0700	-1510.2108 (269)
Primary energy kWh/year			6831.3960 (272)
Primary energy kWh/m2/year			72.9071 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
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	-£ 81	-248 kg (20.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£81 2.65 kg/m²	B 87	B 89
Total Savings	£81 2.65 kg/m²		

Potential energy efficiency rating: B 87
Potential environmental impact rating: B 89

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

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

	Current	Potential	Saving
Electricity	£169	£184	-£16
Mains gas	£521	£425	£97
Space heating	£382	£383	-£1
Water heating	£184	£102	£82
Lighting	£125	£125	£0
Generated (PV)	-£153	-£153	£0
Total cost of fuels	£537	£456	£81
Total cost of uses	£538	£457	£81
Delivered energy	59 kWh/m²	46 kWh/m²	13 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	13 kg/m²	10 kg/m²	3 kg/m²
Primary energy	73 kWh/m²	58 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 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												4.4000
Infiltration rate												0.2200 (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) =	0.2200 (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												
	0.2805	0.2750	0.2695	0.2420	0.2365	0.2090	0.2090	0.2035	0.2200	0.2365	0.2475	0.2585 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5305	0.5250	0.5195	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5085 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.4349	41.0053	40.5758	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.7166 (38)
Heat transfer coeff	125.5334	125.1038	124.6742	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.1512	123.8151 (39)
Average = Sum(39)m / 12 =												123.6947 (39)
HLP	Jan 1.3397	Feb 1.3352	Mar 1.3306	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 1.3214 (40)
HLP (average)												1.3201 (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	
East					3.6600	19.6403	0.7200	0.7000	0.7700	25.1068 (76)		
West					4.9500	19.6403	0.7200	0.7000	0.7700	33.9560 (80)		
East					4.5200	19.6403	0.7200	0.7000	0.7700	31.0063 (76)		
East					1.9700	26.6635	0.6300	0.7000	1.0000	20.8480 (82)		
Solar gains	110.9171	218.6832	364.2982	537.7128	664.6035	682.8101	649.0492	553.7754	425.7886	260.5866	138.6088	91.0148 (83)
Total gains	757.2633	860.2315	980.6539	1111.3169	1194.2081	1178.5044	1125.1894	1039.7996	940.0759	816.3478	736.9262	720.5097 (84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	16.4796	16.5362	16.5932	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7984	16.7083	
alpha	2.0986	2.1024	2.1062	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1199	2.1139	
util living area	0.9213	0.8969	0.8516	0.7723	0.6652	0.5367	0.4225	0.4643	0.6446	0.8151	0.8972	0.9278	(86)
MIT	18.1697	18.4813	19.0253	19.7094	20.2832	20.6821	20.8642	20.8289	20.5020	19.7430	18.8541	18.1244	(87)
Th 2	19.8098	19.8134	19.8170	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8296	19.8241	(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	0.9110	0.8836	0.8323	0.7418	0.6179	0.4653	0.3273	0.3682	0.5783	0.7831	0.8818	0.9184 (89)
MIT 2	16.1041	16.5483	17.3195	18.2762	19.0457	19.5448	19.7417	19.7119	19.3472	18.3482	17.0960	16.0443 (90)
Living area fraction									fLA = Living area / (4) =			0.0971 (91)
MIT	16.3048	16.7360	17.4851	18.4154	19.1659	19.6552	19.8507	19.8204	19.4594	18.4837	17.2668	16.2463 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.1548	16.5860	17.3351	18.2654	19.0159	19.5052	19.7007	19.6704	19.3094	18.3337	17.1168	16.0963 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8643	0.8328	0.7785	0.6920	0.5801	0.4434	0.3159	0.3538	0.5440	0.7301	0.8311	0.8737 (94)	
Useful gains	654.5005	716.3682	763.4377	769.0333	692.8006	522.5414	355.4290	367.9059	511.3981	596.0430	612.4348	629.5092 (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	1488.1676	1461.9682	1350.8640	1153.3613	900.9590	604.0828	381.8607	402.7548	641.5412	952.4136	1233.5765	1472.9468 (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	620.2484	501.0432	437.0451	276.7162	154.8699	0.0000	0.0000	0.0000	0.0000	265.1397	447.2221	627.5176 (98)	
Space heating												3329.8021 (98)	
Space heating per m2												35.5368 (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													3683.4094 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	620.2484	501.0432	437.0451	276.7162	154.8699	0.0000	0.0000	0.0000	0.0000	265.1397	447.2221	627.5176 (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)	686.1155	554.2513	483.4570	306.1020	171.3163	0.0000	0.0000	0.0000	0.0000	293.2961	494.7147	694.1566 (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	87.8458	87.9659	88.0940	88.4237	88.9328	79.7000	79.7000	79.7000	79.7000	86.9559	87.4789	87.8765 (217)	
Fuel for water heating, kWh/month	195.1866	147.8748	120.1593	62.5022	24.3976	7.8354	1.3404	39.4315	76.5976	127.6005	169.2526	194.3040 (219)	
Water heating fuel used												1166.4826 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3683.4094 (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 * 0.64 * 853 * 1.00) =										-436.7513			-436.7513 (233)
Total delivered energy for all uses													5005.3995 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3683.4094	3.4800	128.1826 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1166.4826	3.4800	40.5936 (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	-436.7513	13.1900	-57.6075 (252)	
Total energy cost			309.2877 (255)	

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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)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9366 (257)
SAP value		86.9350
SAP rating (Section 12)		87 (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	3683.4094	0.2160	795.6164 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1166.4826	0.2160	251.9602 (264)
Space and water heating			1047.5767 (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	-436.7513	0.5190	-226.6739 (269)
Total kg/year			1128.2851 (272)
CO2 emissions per m2			12.0400 (273)
EI value			89.0995
EI rating			89 (274)
EI band			B

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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	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															4.4000		
Infiltration rate															0.2200 (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) =					0.2200 (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	0.2420	0.2255	0.2255	0.2145	0.2145	0.2035	0.2035	0.1925	0.1925	0.2090	0.2035	0.2145 (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)

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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	
East					3.6600	25.1925	0.7200		0.7000		0.7700		32.2045 (76)	
West					4.9500	25.1925	0.7200		0.7000		0.7700		43.5553 (80)	
East					4.5200	25.1925	0.7200		0.7000		0.7700		39.7717 (76)	
East					1.9700	34.6424	0.6300		0.7000		1.0000		27.0867 (82)	
Solar gains	142.6182	239.2173	400.6577	592.3733	690.0394	776.2467	712.2715	635.8502	490.0971	303.4334	177.6478	110.7661 (83)		
Total gains	788.9644	880.7657	1017.0134	1165.9774	1219.6441	1271.9410	1188.4117	1121.8744	1004.3844	859.1946	775.9653	740.2610 (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	0.9047	0.8804	0.8235	0.7288	0.6002	0.4308	0.3180	0.3342	0.5526	0.7610	0.8700	0.9133	(86)
MIT	18.5340	18.7856	19.3400	19.9688	20.5080	20.8364	20.9418	20.9358	20.6998	20.0716	19.2095	18.4821	(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)

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util rest of house	0.8920	0.8647	0.8000	0.6921	0.5425	0.3485	0.2136	0.2255	0.4709	0.7177	0.8496	0.9014 (89)
MIT 2	16.6331	16.9887	17.7671	18.6278	19.3318	19.7086	19.8047	19.8019	19.5770	18.7945	17.6008	16.5611 (90)
Living area fraction									fLA = Living area / (4) =			0.0971 (91)
MIT	16.8177	17.1632	17.9199	18.7580	19.4460	19.8181	19.9151	19.9120	19.6860	18.9185	17.7571	16.7477 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6677	17.0132	17.7699	18.6080	19.2960	19.6681	19.7651	19.7620	19.5360	18.7685	17.6071	16.5977 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8426	0.8126	0.7470	0.6466	0.5129	0.3363	0.2075	0.2188	0.4479	0.6691	0.7964	0.8534	(94)
Useful gains	664.8029	715.7049	759.6703	753.9314	625.5089	427.7194	246.6492	245.4305	449.8380	574.9088	617.9630	631.7507	(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													
	1387.6275	1368.6053	1252.4337	1060.0886	763.0446	464.0474	254.3212	253.9361	521.6693	833.5508	1133.8594	1366.6892	(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													
	537.7815	438.7491	366.6160	220.4332	102.3266	0.0000	0.0000	0.0000	0.0000	192.4296	371.4454	546.7942	(98)
Space heating													2776.5756 (98)
Space heating per m2													29.6326 (99)
										(98) / (4) =			

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													3071.4332 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	537.7815	438.7491	366.6160	220.4332	102.3266	0.0000	0.0000	0.0000	0.0000	192.4296	371.4454	546.7942 (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)	594.8910	485.3419	405.5487	243.8420	113.1932	0.0000	0.0000	0.0000	0.0000	212.8646	410.8910	604.8608 (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	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	87.6148	87.7080	87.7748	88.0887	87.9778	79.7000	79.7000	79.7000	79.7000	86.2572	87.1528	87.6314 (217)	
Fuel for water heating, kWh/month	190.4283	148.2555	119.7173	60.7879	30.0062	0.0000	0.0000	31.2492	70.4419	124.2606	163.7198	192.0298 (219)	
Water heating fuel used												1130.8966 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3071.4332 (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 * 0.64 * 961 * 1.00) =										-491.9253			-491.9253 (233)
Total delivered energy for all uses													4302.6633 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3071.4332	7.6100	233.7361 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1130.8966	7.6100	86.0612 (247)	
Mechanical ventilation fans	66.2494	31.0800	20.5903 (249)	
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)	
Pump for solar water heating	50.0000	31.0800	15.5400 (249)	
Energy for lighting	401.0095	31.0800	124.6337 (250)	
Additional standing charges			105.0000 (251)	
Energy saving/generation technologies				
PV Unit	-491.9253	31.0800	-152.8904 (252)	
Total energy cost			455.9809 (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 CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3071.4332	0.2160	663.4296 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1130.8966	0.2160	244.2737 (264)
Space and water heating			907.7032 (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	-491.9253	0.5190	-255.3093 (269)
Total kg/year			959.7763 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3071.4332	1.2200	3747.1485 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1130.8966	1.2200	1379.6938 (264)
Space and water heating			5126.8424 (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	-491.9253	3.0700	-1510.2108 (269)
Primary energy kWh/year			5434.8662 (272)
Primary energy kWh/m2/year			58.0028 (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	West
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			
East	0.000	1.000	None
West	0.000	1.000	None

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	3.6600	125.2818	0.7200	0.7000	0.9000	187.1908
West	4.9500	125.2818	0.7200	0.7000	0.9000	253.1679
East	4.5200	125.2818	0.7200	0.7000	0.9000	231.1756
East	1.9700	210.7507	0.6300	0.7000	1.0000	164.7845

total: 836.3189

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	901	836	731	
Total summer gains	510	491	500	
	1411	1327	1231	(P5)

Summer gain/loss ratio	3.56	3.35	3.10	(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	20.40	22.09	21.85	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium