

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-166				Issued on Date	27/09/2022
Assessment Reference	As Built	Prop Type Ref	L Semi As			
Property	6, Belmere Drive, Fair Oak, EASTLEIGH, SO50 7QS					
SAP Rating		86 B	DER	14.82	TER	18.19
Environmental		88 B	% DER<TER	18.55		
CO ₂ Emissions (t/year)		1.15	DFEE	48.69	TFEE	58.10
General Requirements Compliance		Pass	% DFEE<TFEE	16.20		
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

Semi-Detached House, total floor area 94 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.19 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.82 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (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: 4.21 (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: 1.06 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 (Thames Valley): 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		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.6830 (5)
Dwelling volume			

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														4.2100
Infiltration rate														0.2105 (18)
Number of sides sheltered														1 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.1947 (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														
	0.2483	0.2434	0.2385	0.2142	0.2093	0.1850	0.1850	0.1801	0.1947	0.2093	0.2191	0.2288 (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	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (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)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.4390		(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
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) =		7851.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.7918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss						(33) + (36) =	75.4038 (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	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565 (39)
Average = Sum(39)m / 12 =												114.4565 (39)
HLP	Jan 1.2215	Feb 1.2215	Mar 1.2215	Apr 1.2215	May 1.2215	Jun 1.2215	Jul 1.2215	Aug 1.2215	Sep 1.2215	Oct 1.2215	Nov 1.2215	Dec 1.2215 (40)
HLP (average)												1.2215 (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)
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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 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):													1.0600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.5724 (55)
Total storage loss	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444	(56)
If cylinder contains dedicated solar storage	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444	(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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293	(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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293	(64)
Heat gains from water heating, kWh/month	71.5940	63.1491	66.4288	59.6993	58.6122	52.5285	50.5968	55.3153	55.1533	61.8974	65.2612	69.9221	(65)
Total per year (kWh/year) = Sum (64)m =													2019.7883 (64)

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	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)	96.2285	93.9719	89.2861	82.9157	78.7798	72.9563	68.0064	74.3485	76.6019	83.1954	90.6406	93.9814	(72)
Total internal gains	430.7537	428.5082	413.6305	389.5965	365.0580	341.5597	326.3990	332.7301	345.1753	369.4325	397.2803	418.2957	(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	541.6708	647.1913	777.9288	927.3093	1029.6614	1024.3698	975.4483	886.5055	770.9639	630.0191	535.8891	509.3106	(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)	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	
tau	0.9584	0.9377	0.8962	0.8181	0.7057	0.5722	0.4534	0.5036	0.7025	0.8731	0.9423	0.9635	(86)
alpha	18.1372	18.4587	19.0210	19.7122	20.3053	20.6991	20.8738	20.8353	20.4898	19.6835	18.7670	18.0552	(87)
util living area	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	(88)
MIT	0.9526	0.9291	0.8817	0.7919	0.6616	0.5027	0.3587	0.4081	0.6411	0.8488	0.9329	0.9584	(89)
Th 2	16.0800	16.5435	17.3494	18.3223	19.1272	19.6259	19.8180	19.7849	19.3912	18.3072	16.9963	15.9616	(90)
util rest of house	16.2798	16.7295	17.5118	18.4573	19.2416	19.7301	19.9205	19.8869	19.4979	18.4409	17.1683	16.1649	(91)
MIT 2	16.1298	16.5795	17.3618	18.3073	19.0916	19.5801	19.7705	19.7369	19.3479	18.2909	17.0183	16.0149	(92)
Living area fraction													
Temperature adjustment													
adjusted MIT													

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9211	0.8904	0.8354	0.7442	0.6237	0.4800	0.3463	0.3921	0.6041	0.8000	0.8949	0.9292	(94)
Useful gains	498.9338	576.2546	649.8511	690.1286	642.2195	491.6772	337.7540	347.6106	465.7257	503.9943	479.5864	473.2431	(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)

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Heat loss rate W	1353.9961	1336.7976	1243.1987	1076.7287	846.0190	570.0094	362.8865	381.9326	600.6581	880.2682	1135.2148	1352.2966 (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	636.1664	511.0849	441.4506	278.3521	151.6268	0.0000	0.0000	0.0000	0.0000	279.9478	472.0525	654.0158 (98)
Space heating												3424.6968 (98)
Space heating per m2											(98) / (4) =	36.5496 (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												3788.3814 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	636.1664	511.0849	441.4506	278.3521	151.6268	0.0000	0.0000	0.0000	0.0000	279.9478	472.0525	654.0158 (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)	703.7238	565.3594	488.3304	307.9116	167.7287	0.0000	0.0000	0.0000	0.0000	309.6767	522.1820	723.4688 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (64)
Efficiency of water heater	87.5837	87.3895	86.9548	86.0971	84.5488	79.7000	79.7000	79.7000	79.7000	86.0178	87.1470	79.7000 (216)
Fuel for water heating, kWh/month	228.7609	201.8633	212.5507	191.7213	190.7943	180.0505	172.1554	189.9610	189.9555	199.0223	208.6063	222.7435 (219)
Water heating fuel used												2388.1850 (219)
Annual totals kWh/year												
Space heating fuel - main system												3788.3814 (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												6282.0739 (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	3788.3814	0.2160	818.2904 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2388.1850	0.2160	515.8480 (264)
Space and water heating			1334.1383 (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			1388.8967 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.8200 (273)

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

DER		14.8200 ZC1
Total Floor Area		93.7000
Assumed number of occupants		2.6731
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190
CO2 emissions from appliances, equation (L14)		15.5400 ZC2
CO2 emissions from cooking, equation (L16)		1.9547 ZC3
Total CO2 emissions		32.3147 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		32.3147 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	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					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3485 (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	0.4443	0.4356	0.4269	0.3833	0.3746	0.3311	0.3311	0.3224	0.3485	0.3746	0.3921	0.4095 (22b)
Effective ac	0.5987	0.5949	0.5911	0.5735	0.5702	0.5548	0.5548	0.5520	0.5607	0.5702	0.5769	0.5838 (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	103.8500	15.2500	88.6000	0.1800	15.9480		(29a)
Rooflight Stud Wall			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)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.6389		(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)							18.2764 (36)
Total fabric heat loss						(33) + (36) =	70.9153 (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	46.7629	46.4635	46.1700	44.7916	44.5337	43.3332	43.3332	43.1109	43.7956	44.5337	45.0554	45.6009 (38)
Average = Sum(39)m / 12 =	117.6782	117.3788	117.0853	115.7069	115.4490	114.2484	114.2484	114.0261	114.7109	115.4490	115.9707	116.5161 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2559	1.2527	1.2496	1.2349	1.2321	1.2193	1.2193	1.2169	1.2242	1.2321	1.2377	1.2435 (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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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	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	19.8394	(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	19.8394	(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	22.5120	(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	184.4616	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
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	184.4616	(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	81.1328	(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	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	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	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	-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	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	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	55.2944	55.4354	55.5744	56.2365	56.3621	56.9543	56.9543	57.0654	56.7247	56.3621	56.1085	55.8459	
alpha	4.6863	4.6957	4.7050	4.7491	4.7575	4.7970	4.7970	4.8044	4.7816	4.7575	4.7406	4.7231	
util living area													
0.9981	0.9957	0.9870	0.9531	0.8592	0.6892	0.5250	0.5898	0.8481	0.9779	0.9962	0.9986	0.9986	(86)
MIT	19.6097	19.7747	20.0707	20.4614	20.7771	20.9448	20.9879	20.9795	20.8470	20.4188	19.9442	19.5847	(87)
Th 2	19.8755	19.8781	19.8805	19.8922	19.8944	19.9046	19.9046	19.9065	19.9007	19.8944	19.8900	19.8854	(88)
util rest of house													
0.9975	0.9942	0.9823	0.9353	0.8084	0.5933	0.4010	0.4615	0.7736	0.9664	0.9945	0.9981	0.9981	(89)
MIT 2	18.0294	18.2718	18.7032	19.2656	19.6800	19.8690	19.9003	19.8983	19.7782	19.2173	18.5283	17.9995	(90)
Living area fraction													
MIT	18.1829	18.4177	18.8361	19.3817	19.7865	19.9735	20.0060	20.0033	19.8820	19.3340	18.6658	18.1534	(91)
Temperature adjustment													
adjusted MIT	18.1829	18.4177	18.8361	19.3817	19.7865	19.9735	20.0060	20.0033	19.8820	19.3340	18.6658	18.1534	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9959	0.9912	0.9759	0.9247	0.8026	0.5998	0.4128	0.4734	0.7721	0.9581	0.9917	0.9968	0.9968	(94)
Useful gains	550.1793	641.4914	745.2657	828.9142	792.0746	587.8541	385.7059	404.4504	579.7193	599.6805	539.3890	520.4353	(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													
1633.7088	1586.6948	1444.3707	1212.8091	933.5813	613.9087	389.1265	410.8760	663.2582	1008.3310	1341.2997	1625.8013	1625.8013	(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	1.0000	(97a)
Space heating kWh													
806.1460	635.1767	520.1341	276.4044	105.2810	0.0000	0.0000	0.0000	0.0000	304.0360	577.3758	822.3923	822.3923	(98)
Space heating													
4046.9461													(98)
Space heating per m2													
(98) / (4) =													43.1905 (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													4328.2846	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	806.1460	635.1767	520.1341	276.4044	105.2810	0.0000	0.0000	0.0000	0.0000	304.0360	577.3758	822.3923	(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)	862.1882	679.3333	556.2932	295.6196	112.6000	0.0000	0.0000	0.0000	0.0000	325.1721	617.5142	879.5639	(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	88.1221	87.9097	87.3941	86.1381	83.6665	79.8000	79.8000	79.8000	79.8000	86.2894	87.6542	88.2043	(216)	
Fuel for water heating, kWh/month	230.4913	203.5009	214.6363	194.7268	196.1008	183.1675	175.3936	193.1769	193.0600	201.5903	210.4423	224.5759	(219)	
Water heating fuel used												2420.8626	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4328.2846	(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												7225.1567	(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	4328.2846	0.2160	934.9095 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2420.8626	0.2160	522.9063 (264)
Space and water heating			1457.8158 (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			1704.8647 (272)
Emissions per m2 for space and water heating			15.5583 (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) = (15.5583 * 1.00) + 2.2212 + 0.4154, rounded to 2 d.p.			18.1900 (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					4.2100
Infiltration rate					0.3373 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3120 (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	0.3977	0.3899	0.3821	0.3432	0.3354	0.2964	0.2964	0.2886	0.3120	0.3354	0.3510	0.3666 (22b)
Effective ac	0.5791	0.5760	0.5730	0.5589	0.5562	0.5439	0.5439	0.5416	0.5487	0.5562	0.5616	0.5672 (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	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (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)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.4390		(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
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) =	7571.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							80.8046 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss						(33) + (36) =	75.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.2309	44.9910	44.7559	43.6513	43.4447	42.4827	42.4827	42.3045	42.8532	43.4447	43.8627	44.2998 (38)
Average = Sum(39)m / 12 =	120.6347	120.3948	120.1597	119.0551	118.8485	117.8865	117.8865	117.7083	118.2570	118.8485	119.2666	119.7036 (39)
												119.0542 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2875	1.2849	1.2824	1.2706	1.2684	1.2581	1.2581	1.2562	1.2621	1.2684	1.2729	1.2775 (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

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Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	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			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	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	17.4341	17.4689	17.5031	17.6655	17.6962	17.8406	17.8406	17.8676	17.7847	17.6962	17.6341	17.5698	
alpha	2.1623	2.1646	2.1669	2.1777	2.1797	2.1894	2.1894	2.1912	2.1856	2.1797	2.1756	2.1713	
util living area	0.9643	0.9450	0.9065	0.8323	0.7249	0.5936	0.4757	0.5282	0.7259	0.8876	0.9504	0.9688	(86)
MIT	17.8417	18.1813	18.7795	19.5396	20.1899	20.6416	20.8441	20.7984	20.4008	19.5161	18.5369	17.7791	(87)
Th 2	19.8507	19.8527	19.8547	19.8639	19.8657	19.8738	19.8738	19.8753	19.8707	19.8657	19.8622	19.8585	(88)
util rest of house	0.9592	0.9373	0.8930	0.8072	0.6814	0.5229	0.3767	0.4293	0.6654	0.8651	0.9420	0.9644	(89)
MIT 2	16.9708	17.3073	17.8960	18.6366	19.2452	19.6468	19.8016	19.7756	19.4568	18.6326	17.6699	16.9140	(90)
Living area fraction									fLA = Living area / (4) =			0.0971	(91)
MIT	17.0554	17.3922	17.9818	18.7243	19.3369	19.7434	19.9028	19.8749	19.5484	18.7184	17.7541	16.9980	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0554	17.3922	17.9818	18.7243	19.3369	19.7434	19.9028	19.8749	19.5484	18.7184	17.7541	16.9980	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9415	0.9144	0.8642	0.7766	0.6580	0.5139	0.3794	0.4293	0.6451	0.8355	0.9204	0.9482	(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	1538.7467	1503.9978	1379.6508	1169.6327	907.6366	606.3408	389.3580	409.0291	644.3173	964.8577	1270.6734	1531.9640	(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	803.0423	645.5040	559.2183	350.9771	194.3900	0.0000	0.0000	0.0000	0.0000	356.6795	594.0108	817.7881	(98)
Space heating												4321.6102	(98)
Space heating per m2												(98) / (4) =	46.1218 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	1108.1330	872.3600	894.5834	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7189	0.7786	0.7438	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	796.6298	679.2118	665.3730	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	305.1167	361.1107	296.4763	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													962.7036 (104)
Intermittency factor (Table 10b)													fC = cooled area / (4) = 1.0000 (105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	76.2792	90.2777	74.1191	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													240.6759 (107)
Space cooling per m2													2.5686 (108)
Energy for space heating													46.1218 (99)
Energy for space cooling													2.5686 (108)
Total													48.6904 (109)
Dwelling Fabric Energy Efficiency (DFEE)													48.7 (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										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3485 (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	0.4443	0.4356	0.4269	0.3833	0.3746	0.3311	0.3311	0.3224	0.3485	0.3746	0.3921	0.4095	(22b)				
Effective ac	0.5987	0.5949	0.5911	0.5735	0.5702	0.5548	0.5548	0.5520	0.5607	0.5702	0.5769	0.5838	(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	103.8500	15.2500	88.6000	0.1800	15.9480			(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)			211.6500					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.6389			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								18.2764 (36)					
Total fabric heat loss						(33) + (36) =		70.9153 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 46.7629	Feb 46.4635	Mar 46.1700	Apr 44.7916	May 44.5337	Jun 43.3332	Jul 43.3332	Aug 43.1109	Sep 43.7956	Oct 44.5337	Nov 45.0554	Dec 45.6009	(38)
Heat transfer coeff	117.6782	117.3788	117.0853	115.7069	115.4490	114.2484	114.2484	114.0261	114.7109	115.4490	115.9707	116.5161	(39)
Average = Sum(39)m / 12 =												115.7056	(39)
HLP	Jan 1.2559	Feb 1.2527	Mar 1.2496	Apr 1.2349	May 1.2321	Jun 1.2193	Jul 1.2193	Aug 1.2169	Sep 1.2242	Oct 1.2321	Nov 1.2377	Dec 1.2435	(40)
HLP (average)												1.2349	(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	55.2944	55.4354	55.5744	56.2365	56.3621	56.9543	56.9543	57.0654	56.7247	56.3621	56.1085	55.8459	
alpha	4.6863	4.6957	4.7050	4.7491	4.7575	4.7970	4.7970	4.8044	4.7816	4.7575	4.7406	4.7231	
util living area	0.9990	0.9974	0.9913	0.9649	0.8844	0.7251	0.5602	0.6319	0.8823	0.9862	0.9979	0.9993	(86)
MIT	19.5358	19.7022	20.0025	20.4043	20.7409	20.9313	20.9841	20.9727	20.8125	20.3547	19.8726	19.5112	(87)
Th 2	19.8755	19.8781	19.8805	19.8922	19.8944	19.9046	19.9046	19.9065	19.9007	19.8944	19.8900	19.8854	(88)
util rest of house	0.9987	0.9965	0.9880	0.9509	0.8388	0.6295	0.4300	0.4985	0.8166	0.9786	0.9971	0.9990	(89)
MIT 2	18.5413	18.7094	19.0098	19.4116	19.7200	19.8734	19.9007	19.8988	19.7935	19.3710	18.8891	18.5245	(90)
Living area fraction													(91)
MIT	18.6379	18.8058	19.1062	19.5080	19.8192	19.9762	20.0059	20.0031	19.8925	19.4665	18.9846	18.6203	(92)
Temperature adjustment													(93)
adjusted MIT	18.6379	18.8058	19.1062	19.5080	19.8192	19.9762	20.0059	20.0031	19.8925	19.4665	18.9846	18.6203	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9953	0.9849	0.9446	0.8351	0.6364	0.4426	0.5111	0.8160	0.9744	0.9960	0.9986	(94)
Useful gains	475.7811	569.5512	680.0127	779.7337	766.1093	580.8052	384.5163	401.9702	556.6308	540.6595	468.2573	446.5156	(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	1687.2561	1632.2442	1476.0045	1227.4167	937.3530	614.2174	389.1192	410.8450	664.4586	1023.6276	1378.2693	1680.1972	(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	901.3374	714.1297	592.2179	322.3318	127.4053	0.0000	0.0000	0.0000	0.0000	359.3283	655.2086	917.8591	(98)
Space heating												4589.8181	(98)
Space heating per m2											(98) / (4) =	48.9842	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1073.9353	845.4384	866.5985	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8522	0.9141	0.8813	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	915.1799	772.8390	763.7690	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	163.9109	236.5085	176.0739	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												576.4934 (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	40.9777	59.1271	44.0185	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												144.1233 (107)
Space cooling per m2												1.5381 (108)
Energy for space heating												48.9842 (99)
Energy for space cooling												1.5381 (108)
Total												50.5223 (109)
Target Fabric Energy Efficiency (TFEE)												58.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.2100
Infiltration rate												0.2105 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1947 (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												
	0.2142	0.1996	0.1996	0.1898	0.1898	0.1801	0.1801	0.1704	0.1704	0.1850	0.1801	0.1898 (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	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (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)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4390			(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber PF			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) =				7851.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.7918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss						(33) + (36) =	75.4038 (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	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565 (39)
Average = Sum(39)m / 12 =												114.4565 (39)
HLP	Jan 1.2215	Feb 1.2215	Mar 1.2215	Apr 1.2215	May 1.2215	Jun 1.2215	Jul 1.2215	Aug 1.2215	Sep 1.2215	Oct 1.2215	Nov 1.2215	Dec 1.2215 (40)
HLP (average)												1.2215 (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)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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 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):												1.0600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5724 (55)
Total storage loss	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444 (56)
If cylinder contains dedicated solar storage	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (64)
RHI water heating demand												2019.7883 (64)
Heat gains from water heating, kWh/month	71.5940	63.1491	66.4288	59.6993	58.6122	52.5285	50.5968	55.3153	55.1533	61.8974	65.2612	69.9221 (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)	96.2285	93.9719	89.2861	82.9157	78.7798	72.9563	68.0064	74.3485	76.6019	83.1954	90.6406	93.9814 (72)
Total internal gains	629.9181	625.1202	601.4284	564.6800	526.9339	493.2737	473.7196	482.6030	503.8624	540.8339	581.8893	613.0667 (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	772.5363	864.3375	1002.0861	1157.0533	1216.9733	1269.5204	1185.9911	1118.4533	993.9594	844.2672	759.5371	723.8328 (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	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545
alpha	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703
util living area	0.9095	0.8843	0.8245	0.7230	0.5865	0.4136	0.3019	0.3181	0.5404	0.7599	0.8741	0.9183 (86)
MIT	18.7733	19.0179	19.5452	20.1312	20.6083	20.8794	20.9596	20.9550	20.7629	20.2010	19.3998	18.7189 (87)
Th 2	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028 (88)
util rest of house	0.8974	0.8693	0.8016	0.6870	0.5309	0.3372	0.2076	0.2194	0.4626	0.7178	0.8546	0.9071 (89)
MIT 2	16.9928	17.3397	18.0818	18.8837	19.5039	19.8124	19.8849	19.8827	19.7012	19.0041	17.8934	16.9168 (90)
Living area fraction	17.1657	17.5027	18.2239	19.0049	19.6112	19.9161	19.9893	19.9868	19.8043	19.1203	18.0397	17.0918 (92)
MIT	17.0157	17.3527	18.0739	18.8549	19.4612	19.7661	19.8393	19.8368	19.6543	18.9703	17.8897	16.9418 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8529	0.8221	0.7537	0.6471	0.5062	0.3271	0.2019	0.2132	0.4432	0.6743	0.8064	0.8640 (94)
	658.9271	710.5724	755.2923	748.7368	616.0878	415.2900	239.4197	238.4734	440.4822	569.3271	612.4913	625.4147 (95)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	1329.4894	1310.8390	1198.8054	1013.5007	728.0766	442.4955	244.8579	244.5743	498.3746	797.8012	1086.1541	1309.5887 (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	498.8983	403.3792	329.9738	190.6300	83.3197	0.0000	0.0000	0.0000	0.0000	169.9847	341.0372	509.0254 (98)
Space heating												2526.2482 (98)
RHI space heating demand												2526 (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		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.6830 (5)
Dwelling volume			

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												4.2100
Infiltration rate												0.2105 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1947 (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												
	0.2483	0.2434	0.2385	0.2142	0.2093	0.1850	0.1850	0.1801	0.1947	0.2093	0.2191	0.2288 (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	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (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)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.4390		(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
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) =	7851.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.7918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss						(33) + (36) =	75.4038 (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	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527 (38)
Heat transfer coeff	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565 (39)
Average = Sum(39)m / 12 =												114.4565 (39)
HLP	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215 (40)
HLP (average)												1.2215 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 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):												1.0600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5724 (55)
Total storage loss	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444 (56)
If cylinder contains dedicated solar storage	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (64)
Heat gains from water heating, kWh/month	71.5940	63.1491	66.4288	59.6993	58.6122	52.5285	50.5968	55.3153	55.1533	61.8974	65.2612	69.9221 (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)	96.2285	93.9719	89.2861	82.9157	78.7798	72.9563	68.0064	74.3485	76.6019	83.1954	90.6406	93.9814 (72)
Total internal gains	629.9181	625.1202	601.4284	564.6800	526.9339	493.2737	473.7196	482.6030	503.8624	540.8339	581.8893	613.0667 (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	740.8352	843.8034	965.7266	1102.3928	1191.5374	1176.0837	1122.7688	1036.3784	929.6509	801.4205	720.4981	704.0816 (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	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545
alpha	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703
util living area	0.9254	0.9002	0.8526	0.7689	0.6542	0.5210	0.4053	0.4477	0.6360	0.8166	0.9021	0.9327 (86)
MIT	18.4794	18.7728	19.2805	19.8952	20.4142	20.7537	20.9002	20.8715	20.5918	19.8981	19.0651	18.3965 (87)
Th 2	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028 (88)
util rest of house	0.9159	0.8876	0.8339	0.7390	0.6083	0.4532	0.3173	0.3581	0.5719	0.7856	0.8875	0.9240 (89)
MIT 2	16.5692	16.9882	17.7089	18.5640	19.2583	19.6803	19.8372	19.8131	19.5039	18.5927	17.4165	16.4506 (90)
Living area fraction	16.7548	17.1615	17.8616	18.6933	19.3705	19.7846	19.9404	19.9159	19.6095	18.7195	17.5766	16.6396 (92)
Temperature adjustment	16.6048	17.0115	17.7116	18.5433	19.2205	19.6346	19.7904	19.7659	19.4595	18.5695	17.4266	16.4896 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8744	0.8421	0.7856	0.6946	0.5760	0.4352	0.3077	0.3460	0.5423	0.7378	0.8417	0.8842 (94)
Ext temp.	647.7760	710.5492	758.6823	765.7680	686.3388	511.8077	345.4256	358.6077	504.1880	591.2684	606.4647	622.5240 (95)
	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)

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Heat loss rate W	1408.3591	1386.2388	1283.2370	1103.7403	860.7750	576.2380	365.1662	385.2512	613.4320	912.1558	1181.9450	1406.6274 (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	565.8739	454.0634	390.2687	243.3401	129.7806	0.0000	0.0000	0.0000	0.0000	238.7402	414.3458	583.3730 (98)
Space heating												3019.7855 (98)
Space heating per m2										(98) / (4) =		32.2282 (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												3340.4707 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	565.8739	454.0634	390.2687	243.3401	129.7806	0.0000	0.0000	0.0000	0.0000	238.7402	414.3458	583.3730 (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)	625.9667	502.2825	431.7132	269.1815	143.5626	0.0000	0.0000	0.0000	0.0000	264.0931	458.3472	645.3241 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (64)
Efficiency of water heater	87.3341	87.1271	86.6609	85.7472	84.1401	79.7000	79.7000	79.7000	79.7000	85.6007	86.8445	79.7000 (216)
(217)m	87.3341	87.1271	86.6609	85.7472	84.1401	79.7000	79.7000	79.7000	79.7000	85.6007	86.8445	79.7000 (216)
Fuel for water heating, kWh/month	229.4147	202.4713	213.2716	192.5037	191.7211	180.0505	172.1554	189.9610	189.9555	199.9921	209.3330	223.3487 (219)
Water heating fuel used												2394.1784 (219)
Annual totals kWh/year												
Space heating fuel - main system												3340.4707 (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												5840.1567 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3340.4707	3.4800	116.2484 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2394.1784	3.4800	83.3174 (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			333.4822 (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] =	1.0098 (257)
SAP value		85.9130
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3340.4707	0.2160	721.5417 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2394.1784	0.2160	517.1425 (264)
Space and water heating			1238.6842 (265)
Pumps and fans	141.2494	0.5190	73.3084 (267)

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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			1293.4426 (272)
CO2 emissions per m2			13.8000 (273)
EI value			87.5039
EI rating			88 (274)
EI band			B

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

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8414 = 4.136$, stars = 4
Water heating environmental impact	$0.216 / 0.8414 = 0.2567$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.2100
Infiltration rate												0.2105 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1947 (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												
	0.2142	0.1996	0.1996	0.1898	0.1898	0.1801	0.1801	0.1704	0.1704	0.1850	0.1801	0.1898 (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	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (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)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4390			(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber PF			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) =				7851.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.7918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss						(33) + (36) =	75.4038 (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	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565 (39)
Average = Sum(39)m / 12 =												114.4565 (39)
HLP	Jan 1.2215	Feb 1.2215	Mar 1.2215	Apr 1.2215	May 1.2215	Jun 1.2215	Jul 1.2215	Aug 1.2215	Sep 1.2215	Oct 1.2215	Nov 1.2215	Dec 1.2215 (40)
HLP (average)												1.2215 (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)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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 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):													1.0600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.5724 (55)
Total storage loss	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444	(56)
If cylinder contains dedicated solar storage	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444	(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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293	(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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293	(64)
Heat gains from water heating, kWh/month	71.5940	63.1491	66.4288	59.6993	58.6122	52.5285	50.5968	55.3153	55.1533	61.8974	65.2612	69.9221	(65)
Total per year (kWh/year) = Sum(64)m =													2019.7883 (64)

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)
(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)	96.2285	93.9719	89.2861	82.9157	78.7798	72.9563	68.0064	74.3485	76.6019	83.1954	90.6406	93.9814	(72)
Total internal gains	629.9181	625.1202	601.4284	564.6800	526.9339	493.2737	473.7196	482.6030	503.8624	540.8339	581.8893	613.0667	(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	772.5363	864.3375	1002.0861	1157.0533	1216.9733	1269.5204	1185.9911	1118.4533	993.9594	844.2672	759.5371	723.8328 (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)	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	
tau	0.9095	0.8843	0.8245	0.7230	0.5865	0.4136	0.3019	0.3181	0.5404	0.7599	0.8741	0.9183	(86)
alpha	18.7733	19.0179	19.5452	20.1312	20.6083	20.8794	20.9596	20.9550	20.7629	20.2010	19.3998	18.7189	(87)
util living area	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	(88)
MIT	0.8974	0.8693	0.8016	0.6870	0.5309	0.3372	0.2076	0.2194	0.4626	0.7178	0.8546	0.9071	(89)
MIT 2	16.9928	17.3397	18.0818	18.8837	19.5039	19.8124	19.8849	19.8827	19.7012	19.0041	17.8934	16.9168	(90)
Living area fraction	17.1657	17.5027	18.2239	19.0049	19.6112	19.9161	19.9893	19.9868	19.8043	19.1203	18.0397	17.0918	(91)
MIT	17.1657	17.5027	18.2239	19.0049	19.6112	19.9161	19.9893	19.9868	19.8043	19.1203	18.0397	17.0918	(92)
Temperature adjustment	17.0157	17.3527	18.0739	18.8549	19.4612	19.7661	19.8393	19.8368	19.6543	18.9703	17.8897	16.9418	(93)
adjusted MIT	17.0157	17.3527	18.0739	18.8549	19.4612	19.7661	19.8393	19.8368	19.6543	18.9703	17.8897	16.9418	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8529	0.8221	0.7537	0.6471	0.5062	0.3271	0.2019	0.2132	0.4432	0.6743	0.8064	0.8640	(94)
Useful gains	658.9271	710.5724	755.2923	748.7368	616.0878	415.2900	239.4197	238.4734	440.4822	569.3271	612.4913	625.4147	(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 EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Heat loss rate W	1329.4894	1310.8390	1198.8054	1013.5007	728.0766	442.4955	244.8579	244.5743	498.3746	797.8012	1086.1541	1309.5887 (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	498.8983	403.3792	329.9738	190.6300	83.3197	0.0000	0.0000	0.0000	0.0000	169.9847	341.0372	509.0254 (98)
Space heating												2526.2482 (98)
Space heating per m2										(98) / (4) =		26.9610 (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												2794.5224 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	498.8983	403.3792	329.9738	190.6300	83.3197	0.0000	0.0000	0.0000	0.0000	169.9847	341.0372	509.0254 (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)	551.8787	446.2159	365.0152	210.8739	92.1678	0.0000	0.0000	0.0000	0.0000	188.0362	377.2535	563.0812 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (64)
Efficiency of water heater	87.0513	86.8522	86.2431	85.0982	83.0479	79.7000	79.7000	79.7000	79.7000	84.6946	86.3682	79.7000 (216)
(217)m												87.1552 (217)
Fuel for water heating, kWh/month	230.1599	203.1121	214.3048	193.9719	194.2425	180.0505	172.1554	189.9610	189.9555	202.1318	210.4874	224.1167 (219)
Water heating fuel used												2404.6494 (219)
Annual totals kWh/year												
Space heating fuel - main system												2794.5224 (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												5249.5053 (238)

10a. Fuel costs - using BEDF prices (505)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	2794.5224	3.7400	104.5151 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2404.6494	3.7400	89.9339 (247)
Mechanical ventilation fans	66.2494	20.4300	13.5347 (249)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	401.0095	20.4300	81.9262 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-491.9253	20.4300	-100.5003 (252)
Total energy cost			299.7322 (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	2794.5224	0.2160	603.6168 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2404.6494	0.2160	519.4043 (264)
Space and water heating			1123.0211 (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			1149.1442 (272)

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

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Calculation Type: New Build (As Built)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2794.5224	1.2200	3409.3173 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2404.6494	1.2200	2933.6723 (264)
Space and water heating			6342.9896 (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			6497.5134 (272)
Primary energy kWh/m2/year			69.3438 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 88

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.5	-£ 38	-250 kg (21.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£38	2.66 kg/m²	B 87 B 90
Total Savings	£38	2.66 kg/m²	

Potential energy efficiency rating: B 87
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 505 TEST (31 Aug 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£111	£121	-£10
Mains gas	£289	£242	£48
Space heating	£228	£228	-£0
Water heating	£90	£52	£38
Lighting	£82	£82	£0
Generated (PV)	-£101	-£101	£0
Total cost of fuels	£299	£262	£38
Total cost of uses	£299	£261	£38
Delivered energy	56 kWh/m²	43 kWh/m²	13 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	12 kg/m²	10 kg/m²	3 kg/m²
Primary energy	69 kWh/m²	54 kWh/m²	15 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main 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												4.2100
Infiltration rate												0.2105 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1947 (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												
	0.2483	0.2434	0.2385	0.2142	0.2093	0.1850	0.1850	0.1801	0.1947	0.2093	0.2191	0.2288 (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	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (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)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4390			(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
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) =				7851.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.7918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss						(33) + (36) =	75.4038 (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	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565 (39)
Average = Sum(39)m / 12 =												114.4565 (39)
HLP	Jan 1.2215	Feb 1.2215	Mar 1.2215	Apr 1.2215	May 1.2215	Jun 1.2215	Jul 1.2215	Aug 1.2215	Sep 1.2215	Oct 1.2215	Nov 1.2215	Dec 1.2215 (40)
HLP (average)												1.2215 (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)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Average daily hot water use (litres/day)												97.6851 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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	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:												190.0000 (47)
Store volume												1.4400 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7776 (55)
Enter (49) or (54) in (55)												
Total storage loss	24.1051	21.7724	24.1051	23.3275	24.1051	23.3275	24.1051	24.1051	23.3275	24.1051	23.3275	24.1051 (56)
If cylinder contains dedicated solar storage	14.5899	13.1780	14.5899	14.1193	14.5899	14.1193	14.5899	14.5899	14.1193	14.5899	14.1193	14.5899 (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	197.2029	173.5582	180.2729	155.2603	145.3656	127.8408	121.0264	136.1480	142.9389	166.6444	178.7415	192.1748 (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	170.7751	129.4578	105.1649	54.6008	21.0093	5.5788	0.3801	30.7387	60.3823	110.2680	147.3944	170.0593 (64)
Heat gains from water heating, kWh/month	71.5940	63.1491	65.3122	54.2964	48.3767	42.4431	40.1752	45.6381	50.8310	60.7808	65.2612	69.9221 (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)	96.2285	93.9719	87.7853	75.4117	65.0225	58.9488	53.9989	61.3416	70.5987	81.6946	90.6406	93.9814 (72)
Total internal gains	629.9181	625.1202	599.9276	557.1760	513.1765	479.2662	459.7121	469.5961	497.8592	539.3331	581.8893	613.0667 (73)
6. Solar gains												
[Jan]	Area	Solar flux	g	Specific data	FF	Access	Gains					
	m2	Table 6a	W/m2	or Table 6b	Specific data	factor	W					
					or Table 6c	Table 6d						
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	740.8352	843.8034	964.2258	1094.8888	1177.7800	1162.0763	1108.7613	1023.3714	923.6477	799.9197	720.4981	704.0816 (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	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545
alpha	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703
util living area	0.9254	0.9002	0.8530	0.7710	0.6584	0.5254	0.4095	0.4521	0.6383	0.8171	0.9021	0.9327 (86)
MIT	18.4794	18.7728	19.2786	19.8880	20.4058	20.7493	20.8981	20.8688	20.5884	19.8964	19.0651	18.3965 (87)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Th 2	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028 (88)
util rest of house	0.9159	0.8876	0.8343	0.7412	0.6126	0.4574	0.3208	0.3620	0.5743	0.7861	0.8875	0.9240 (89)
MIT 2	16.5692	16.9882	17.7063	18.5546	19.2483	19.6759	19.8356	19.8111	19.5002	18.5904	17.4165	16.4506 (90)
Living area fraction									fLA = Living area / (4) =			0.0971 (91)
MIT	16.7548	17.1615	17.8590	18.6841	19.3607	19.7802	19.9388	19.9138	19.6059	18.7173	17.5766	16.6396 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6048	17.0115	17.7090	18.5341	19.2107	19.6302	19.7888	19.7638	19.4559	18.5673	17.4266	16.4896 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8744	0.8421	0.7860	0.6967	0.5798	0.4390	0.3110	0.3496	0.5445	0.7383	0.8417	0.8842	(94)
Useful gains	647.7760	710.5492	757.8760	762.7848	682.9320	510.1656	344.8018	357.7982	502.9209	590.5771	606.4647	622.5240	(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	1408.3591	1386.2388	1282.9420	1102.6881	859.6523	575.7364	364.9823	385.0096	613.0194	911.9061	1181.9450	1406.6274	(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	565.8739	454.0634	390.6491	244.7304	131.4799	0.0000	0.0000	0.0000	0.0000	239.0688	414.3458	583.3730	(98)
Space heating												3023.5842	(98)
Space heating per m2										(98) / (4) =		32.2688	(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													3344.6727 (211)
Space heating requirement	565.8739	454.0634	390.6491	244.7304	131.4799	0.0000	0.0000	0.0000	0.0000	239.0688	414.3458	583.3730	(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)	625.9667	502.2825	432.1339	270.7195	145.4423	0.0000	0.0000	0.0000	0.0000	264.4566	458.3472	645.3241	(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	170.7751	129.4578	105.1649	54.6008	21.0093	5.5788	0.3801	30.7387	60.3823	110.2680	147.3944	170.0593	(64)
Efficiency of water heater (217)m	87.6714	87.7853	87.8971	88.2391	88.7583	79.7000	79.7000	79.7000	79.7000	86.7249	87.3239	79.7000	(216)
Fuel for water heating, kWh/month	194.7901	147.4710	119.6456	61.8782	23.6702	6.9997	0.4769	38.5680	75.7620	127.1469	168.7904	193.8192	(219)
Water heating fuel used												1159.0182	(219)
Annual totals kWh/year													
Space heating fuel - main system												3344.6727	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, 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												4659.1984	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3344.6727	3.4800	116.3946	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1159.0182	3.4800	40.3338	(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			297.2399	(255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9001 (257)
SAP value		87.4439
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	3344.6727	0.2160	722.4493 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1159.0182	0.2160	250.3479 (264)
Space and water heating			972.7972 (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			1053.5056 (272)
CO2 emissions per m2			11.2400 (273)
EI value			89.8219
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.2100
Infiltration rate												0.2105 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1947 (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												
	0.2142	0.1996	0.1996	0.1898	0.1898	0.1801	0.1801	0.1704	0.1704	0.1850	0.1801	0.1898 (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	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (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)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4390			(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber PF			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) =				7851.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.7918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss			(33) + (36) =				75.4038 (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	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565 (39)
Average = Sum(39)m / 12 =												114.4565 (39)
HLP	Jan 1.2215	Feb 1.2215	Mar 1.2215	Apr 1.2215	May 1.2215	Jun 1.2215	Jul 1.2215	Aug 1.2215	Sep 1.2215	Oct 1.2215	Nov 1.2215	Dec 1.2215 (40)
HLP (average)												1.2215 (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)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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 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:												190.0000 (47)
Store volume												1.4400 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7776 (55)
Enter (49) or (54) in (55)												
Total storage loss	24.1051	21.7724	24.1051	23.3275	24.1051	23.3275	24.1051	24.1051	23.3275	24.1051	23.3275	24.1051 (56)
If cylinder contains dedicated solar storage	14.5899	13.1780	14.5899	14.1193	14.5899	14.1193	14.5899	14.5899	14.1193	14.5899	14.1193	14.5899 (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	197.2029	173.5582	180.2729	155.2603	145.3656	127.8408	121.0264	136.1480	142.9389	166.6444	178.7415	192.1748 (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	166.1552	129.4104	104.3934	52.8813	25.7106	0.0000	0.0000	24.2174	55.4762	106.4956	142.0203	167.5902 (64)
Heat gains from water heating, kWh/month	71.5940	63.1491	65.3122	54.2964	48.3767	42.4431	40.1752	45.6381	50.8310	60.7808	65.2612	69.9221 (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)	96.2285	93.9719	87.7853	75.4117	65.0225	58.9488	53.9989	61.3416	70.5987	81.6946	90.6406	93.9814 (72)
Total internal gains	629.9181	625.1202	599.9276	557.1760	513.1765	479.2662	459.7121	469.5961	497.8592	539.3331	581.8893	613.0667 (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			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	772.5363	864.3375	1000.5853	1149.5493	1203.2159	1255.5129	1171.9836	1105.4463	987.9562	842.7664	759.5371	723.8328	(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	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545
alpha	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703
util living area	0.9095	0.8843	0.8249	0.7251	0.5907	0.4173	0.3052	0.3214	0.5426	0.7604	0.8741	0.9183 (86)
MIT	18.7733	19.0179	19.5434	20.1252	20.6022	20.8771	20.9587	20.9540	20.7608	20.1996	19.3998	18.7189 (87)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Th 2	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	(88)
util rest of house	0.8974	0.8693	0.8020	0.6893	0.5351	0.3405	0.2099	0.2219	0.4648	0.7184	0.8546	0.9071	(89)
MIT 2	16.9928	17.3397	18.0794	18.8761	19.4971	19.8106	19.8845	19.8822	19.6992	19.0024	17.8934	16.9168	(90)
Living area fraction	17.1657	17.5027	18.2216	18.9974	19.6045	19.9142	19.9888	19.9863	fLA = Living area / (4) =	19.8023	19.1186	18.0397	(91)
MIT	17.1657	17.5027	18.2216	18.9974	19.6045	19.9142	19.9888	19.9863	19.8023	19.1186	18.0397	17.0918	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.0157	17.3527	18.0716	18.8474	19.4545	19.7642	19.8388	19.8363	19.6523	18.9686	17.8897	16.9418	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8529	0.8221	0.7541	0.6492	0.5100	0.3302	0.2041	0.2155	0.4451	0.6749	0.8064	0.8640	(94)
Useful gains	658.9271	710.5724	754.5640	746.2408	613.6633	414.5509	239.2359	238.2725	439.7454	568.7743	612.4913	625.4147	(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	1329.4894	1310.8390	1198.5416	1012.6432	727.3096	442.2791	244.8029	244.5141	498.1470	797.6074	1086.1541	1309.5887	(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	498.8983	403.3792	330.3193	191.8097	84.5529	0.0000	0.0000	0.0000	0.0000	170.2518	341.0372	509.0254	(98)
Space heating												2529.2739	(98)
Space heating per m2										(98) / (4) =		26.9933	(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	2797.8693	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	498.8983	403.3792	330.3193	191.8097	84.5529	0.0000	0.0000	0.0000	0.0000	170.2518	341.0372	509.0254	(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)	551.8787	446.2159	365.3975	212.1789	93.5319	0.0000	0.0000	0.0000	0.0000	188.3317	377.2535	563.0812	(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	166.1552	129.4104	104.3934	52.8813	25.7106	0.0000	0.0000	24.2174	55.4762	106.4956	142.0203	167.5902	(64)
Efficiency of water heater (217)m	87.4662	87.5452	87.5765	87.8511	87.6560	79.7000	79.7000	79.7000	79.7000	85.9592	86.9673	79.7000	(216)
Fuel for water heating, kWh/month	189.9649	147.8212	119.2025	60.1942	29.3313	0.0000	0.0000	30.3857	69.6063	123.8909	163.3031	191.5521	(219)
Water heating fuel used												1125.2521	(219)
Annual totals kWh/year													
Space heating fuel - main system												2797.8693	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:		
(MEVDecentralised, 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		4023.4549 (238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2797.8693	3.7400	104.6403	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1125.2521	3.7400	42.0844	(247)
Mechanical ventilation fans	66.2494	20.4300	13.5347	(249)
Pumps and fans for heating	75.0000	20.4300	15.3225	(249)
Pump for solar water heating	50.0000	20.4300	10.2150	(249)
Energy for lighting	401.0095	20.4300	81.9262	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-491.9253	20.4300	-100.5003	(252)
Total energy cost			262.2229	(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	2797.8693	0.2160	604.3398 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1125.2521	0.2160	243.0545 (264)
Space and water heating			847.3942 (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			899.4673 (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	2797.8693	1.2200	3413.4006 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1125.2521	1.2200	1372.8076 (264)
Space and water heating			4786.2082 (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			5094.2320 (272)
Primary energy kWh/m2/year			54.3675 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	83.8 (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	75.40 (37)
Summer heat loss coefficient	387.83 (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	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	3.6600	117.5071	0.7200	0.7000	0.9000	175.5742
West	4.9500	117.5071	0.7200	0.7000	0.9000	237.4569
East	4.5200	117.5071	0.7200	0.7000	0.9000	216.8293
East	1.9700	197.1775	0.6300	0.7000	1.0000	154.1717
total:						784.0320

	Jun	Jul	Aug	
Solar gains	833	784	686	(P3)
Internal gains	490	471	480	
Total summer gains	1324	1255	1165	(P5)
Summer gain/loss ratio	3.41	3.24	3.00	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 83.8)	1.41	1.41	1.41	
Threshold temperature	20.83	22.55	22.22	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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