

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-104			Issued on Date	26/03/2024
Assessment Reference	As Built	Prop Type Ref	J Mid As		
Property	21, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	87 B	DER	13.33	TER	16.94
Environmental	89 B	% DER<TER	21.33		
CO ₂ Emissions (t/year)	1.13	DFEE	45.12	TFEE	53.02
General Requirements Compliance	Pass	% DFEE<TFEE	14.90		
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

Mid-Terrace House, total floor area 105 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) 16.94 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.33 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)45.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.32 (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	0.16 (max. 0.20)	0.28 (max. 0.35)	OK
Openings	1.41 (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: 4.52 (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 SYSTEM s18

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.20 kWh/day
Permitted by DBSCG 2.03 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing South East: 7.01 m², No overhang
Windows facing North West: 6.17 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

External wall U-value 0.14 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.68 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	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.5200
Infiltration rate					0.2260 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.1921 (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	0.2449	0.2401	0.2353	0.2113	0.2065	0.1825	0.1825	0.1777	0.1921	0.2065	0.2161	0.2257 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
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)			8.6700	1.3258	11.4943		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)
140mm Timber Frame	84.3300	13.9900	70.3400	0.1900	13.3646	9.0000	633.0600 (29a)
Timber Wall to Loft	8.4800		8.4800	0.1900	1.6112	9.0000	76.3200 (29a)
Timber Wall to Garage	14.8000		14.8000	0.1900	2.8120	9.0000	133.2000 (29a)
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)
Total net area of external elements Aum(A, m ²)			219.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.4526		(33)
Timebr Frame			75.3600	0.0000	0.0000	20.0000	1507.2000 (32)
Timber GF			69.8900			9.0000	629.0100 (32c)
Timber FF			98.3300			9.0000	884.9700 (32c)
Timber 2F			30.4100			9.0000	273.6900 (32c)
Internal Floor			41.2000			18.0000	741.6000 (32d)
Internal Floor 2			22.9600			18.0000	413.2800 (32d)
Internal Ceiling			41.2000			18.0000	741.6000 (32e)
Internal Ceiling 2			22.9600			18.0000	413.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10157.3100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 96.4058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.0106 (36)
Total fabric heat loss (33) + (36) = 72.4633 (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	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756 (38)
Heat transfer coeff	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389 (39)
Average = Sum(39)m / 12 =												116.3389 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042 (40)
HLP (average)												1.1042 (40)
Days in month												

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	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (46)
Water storage loss:												170.0000 (47)
Store volume												1.2000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.6480 (55)
Enter (49) or (54) in (55)												
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (64)
Total per year (kWh/year) = Sum (64)m =												2088.8081 (64)
Heat gains from water heating, kWh/month	89.0924	78.9134	83.7881	76.3750	75.7608	69.0109	67.5293	72.3750	71.7065	79.1345	82.0868	87.3756 (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	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5326	22.6778	18.4428	13.9624	10.4371	8.8114	9.5210	12.3758	16.6108	21.0912	24.6166	26.2422 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.7132	267.4601	260.5380	245.8017	227.1998	209.7166	198.0367	195.2898	202.2119	216.9482	235.5501	253.0333 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	119.7479	117.4306	112.6184	106.0763	101.8290	95.8485	90.7652	97.2782	99.5923	106.3636	114.0095	117.4403 (72)
Total internal gains	477.7524	475.3272	459.3580	433.5992	407.2245	382.1352	366.0817	372.7026	386.1737	412.1617	441.9349	464.4745 (73)

6. Solar gains												

[Jan]			Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
Southeast			7.0100		36.7938		0.7200		0.7000		0.7700	90.0859 (77)
Northwest			1.6600		11.2829		0.7200		0.7000		0.7700	6.5418 (81)
Northwest			4.5100		11.2829		0.7200		0.7000		0.7700	17.7731 (81)
Northwest			0.8400		17.4137		0.6300		0.7000		1.0000	5.8057 (82)
Solar gains	120.2064	215.0687	321.7525	444.8908	540.6164	555.3435	527.6526	453.3682	363.9333	245.0987	145.8553	101.6591 (83)
Total gains	597.9588	690.3959	781.1105	878.4900	947.8409	937.4787	893.7342	826.0708	750.1070	657.2604	587.7902	566.1336 (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	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522
alpha	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168
util living area	0.9678	0.9524	0.9237	0.8662	0.7695	0.6360	0.5071	0.5553	0.7476	0.8961	0.9538	0.9719 (86)
MIT	18.5968	18.8585	19.2992	19.8606	20.3788	20.7387	20.8966	20.8654	20.5737	19.9060	19.1387	18.5261 (87)
Th 2	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974 (88)
util rest of house	0.9631	0.9454	0.9121	0.8447	0.7301	0.5685	0.4115	0.4605	0.6905	0.8748	0.9458	0.9678 (89)
MIT 2	16.7712	17.1495	17.7840	18.5809	19.2922	19.7525	19.9264	19.8991	19.5636	18.6600	17.5602	16.6689 (90)
Living area fraction									fLA = Living area / (4) =			0.0815 (91)
MIT	16.9201	17.2888	17.9076	18.6853	19.3808	19.8329	20.0055	19.9779	19.6459	18.7616	17.6889	16.8203 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.7701	17.1388	17.7576	18.5353	19.2308	19.6829	19.8555	19.8279	19.4959	18.6116	17.5389	16.6703 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9398	0.9164	0.8766	0.8049	0.6945	0.5448	0.3967	0.4428	0.6565	0.8352	0.9167	0.9462	(94)
Useful gains	561.9323	632.6845	684.7177	707.0879	658.2630	510.7342	354.5822	365.7437	492.4321	548.9644	538.8308	535.7019	(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	1450.7535	1423.8537	1309.6910	1120.9552	876.1234	591.3362	378.7445	398.7946	627.7572	932.0615	1214.4511	1450.7840	(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	661.2829	531.6657	464.9801	297.9845	162.0881	0.0000	0.0000	0.0000	0.0000	285.0242	486.4466	680.8211	(98)
Space heating												3570.2932	(98)
Space heating per m2											(98) / (4) =	33.8866	(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 %)													90.6000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3940.7210	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	661.2829	531.6657	464.9801	297.9845	162.0881	0.0000	0.0000	0.0000	0.0000	285.0242	486.4466	680.8211	(98)	
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)	
Space heating fuel (main heating system)	729.8929	586.8275	513.2231	328.9012	178.9052	0.0000	0.0000	0.0000	0.0000	314.5963	536.9167	751.4581	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323	(64)	
Efficiency of water heater	87.7970	87.6047	87.1993	86.3864	84.8364	79.9000	79.9000	79.9000	79.9000	86.1781	87.3410	79.9000	(216)	
Fuel for water heating, kWh/month	235.7664	208.0717	219.0876	197.6168	196.7323	185.9404	177.9028	196.1425	196.0869	205.4435	215.1252	229.5948	(219)	
Water heating fuel used												2463.5111	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3940.7210	(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)													74.4310	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													149.4310	(231)
Electricity for lighting (calculated in Appendix L)													450.9135	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.68 * 1029 * 1.00) =													-559.8776	(233)
Total delivered energy for all uses													6444.6989	(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	3940.7210	0.2160	851.1957	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2463.5111	0.2160	532.1184	(264)
Space and water heating			1383.3141	(265)
Pumps and fans	149.4310	0.5190	77.5547	(267)
Energy for lighting	450.9135	0.5190	234.0241	(268)
Energy saving/generation technologies				
PV Unit	-559.8776	0.5190	-290.5765	(269)
Total CO2, kg/year			1404.3164	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3300	(273)

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

DER			13.3300	ZC1
Total Floor Area		TFA	105.3600	
Assumed number of occupants		N	2.7839	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			14.8883	ZC2
CO2 emissions from cooking, equation (L16)			1.7636	ZC3
Total CO2 emissions			29.9819	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			29.9819	ZC8

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1504 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4004 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3404 (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												
Effective ac	0.4340	0.4255	0.4169	0.3744	0.3659	0.3233	0.3233	0.3148	0.3404	0.3659	0.3829	0.3999 (22b)
	0.5942	0.5905	0.5869	0.5701	0.5669	0.5523	0.5523	0.5496	0.5579	0.5669	0.5733	0.5800 (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)			13.1800	1.3258	17.4735		(27)
TER Room Window (Uw = 1.70)			0.8400	1.5918	1.3371		(27a)
150mm EPS B&B			41.2000	0.1300	5.3560		(28a)
140mm Timber Frame	84.3300	13.9900	70.3400	0.1800	12.6612		(29a)
Timber Wall to Loft	8.4800		8.4800	0.1800	1.5264		(29a)
Timber Wall to Garage	14.8000		14.8000	0.1800	2.6640		(29a)
Wall to Void	22.6400		22.6400	0.1800	4.0752		(29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.1800	0.6984		(29a)
400mm Mineral Wool	11.0300		11.0300	0.1300	1.4339		(30)
Sloping	11.1900	0.8400	10.3500	0.1300	1.3455		(30)
C2V	18.2400		18.2400	0.1300	2.3712		(30)
Dormer Roof	2.7600		2.7600	0.1300	0.3588		(30)
Total net area of external elements Aum(A, m ²)			219.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.4212		(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)							13.4453 (36)
Total fabric heat loss						(33) + (36) =	66.8665 (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	52.1384	51.8175	51.5030	50.0258	49.7494	48.4628	48.4628	48.2246	48.9584	49.7494	50.3085	50.8931 (38)
Heat transfer coeff	119.0048	118.6840	118.3695	116.8923	116.6159	115.3293	115.3293	115.0911	115.8249	116.6159	117.1750	117.7595 (39)
Average = Sum(39)m / 12 =												116.8910 (39)
HLP	1.1295	1.1265	1.1235	1.1095	1.1068	1.0946	1.0946	1.0924	1.0993	1.1068	1.1121	1.1177 (40)
HLP (average)												1.1094 (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											
Average daily hot water use (litres/day)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use											

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Energy conte	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)	
Energy content (annual)										Total = Sum(45)m =		1578.3921 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (46)	
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5003 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8102 (55)
Total storage loss												
25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (56)	
If cylinder contains dedicated solar storage												
25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Total heat required for water heating calculated for each month												
212.0232	186.8214	196.0703	175.5791	171.9279	153.4315	147.1716	161.7452	161.5386	182.0745	192.7576	206.8596 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	212.0232	186.8214	196.0703	175.5791	171.9279	153.4315	147.1716	161.7452	161.5386	182.0745	192.7576	206.8596 (64)
Total per year (kWh/year) = Sum(64)m =												2148.0005 (64)
Heat gains from water heating, kWh/month												
93.1143	82.5460	87.8099	80.2671	79.7826	72.9030	71.5511	76.3968	75.5986	83.1563	85.9789	91.3974 (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	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5326	22.6778	18.4428	13.9624	10.4371	8.8114	9.5210	12.3758	16.6108	21.0912	24.6166	26.2422 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.7132	267.4601	260.5380	245.8017	227.1998	209.7166	198.0367	195.2898	202.2119	216.9482	235.5501	253.0333 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	125.1536	122.8363	118.0241	111.4820	107.2347	101.2542	96.1709	102.6839	104.9980	111.7693	119.4152	122.8460 (72)
Total internal gains	483.1581	480.7329	464.7637	439.0049	412.6302	387.5409	371.4874	378.1083	391.5794	417.5674	447.3406	469.8802 (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			
Southeast				7.0100	36.7938	0.6300	0.7000	0.7700	78.8252 (77)			
Northwest				6.1700	11.2829	0.6300	0.7000	0.7700	21.2755 (81)			
Northwest				0.8400	17.4137	0.6300	0.7000	1.0000	5.8057 (82)			
Solar gains	105.9063	189.7008	284.3615	394.0669	479.5868	492.9507	468.2502	401.8556	321.9339	216.3387	128.5433	89.5401 (83)
Total gains	589.0644	670.4337	749.1252	833.0717	892.2170	880.4916	839.7375	779.9639	713.5133	633.9062	575.8839	559.4204 (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	61.4821	61.6483	61.8121	62.5932	62.7416	63.4415	63.4415	63.5729	63.1701	62.7416	62.4422	62.1323
alpha	5.0988	5.1099	5.1208	5.1729	5.1828	5.2294	5.2294	5.2382	5.2113	5.1828	5.1628	5.1422
util living area	0.9986	0.9969	0.9919	0.9724	0.9080	0.7575	0.5864	0.6473	0.8826	0.9832	0.9970	0.9989 (86)
MIT	19.7481	19.8877	20.1282	20.4573	20.7535	20.9359	20.9864	20.9779	20.8475	20.4703	20.0534	19.7272 (87)
Th 2	19.9768	19.9793	19.9817	19.9931	19.9953	20.0052	20.0052	20.0071	20.0014	19.9953	19.9909	19.9864 (88)
util rest of house	0.9981	0.9958	0.9889	0.9612	0.8702	0.6695	0.4630	0.5229	0.8205	0.9744	0.9957	0.9985 (89)
MIT 2	18.3025	18.5081	18.8600	19.3408	19.7439	19.9606	20.0000	19.9975	19.8721	19.3663	18.7590	18.2786 (90)
Living area fraction												0.0815 (91)
MIT	18.4203	18.6206	18.9634	19.4319	19.8262	20.0401	20.0804	20.0774	19.9516	19.4563	18.8646	18.3967 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4203	18.6206	18.9634	19.4319	19.8262	20.0401	20.0804	20.0774	19.9516	19.4563	18.8646	18.3967 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9969	0.9937	0.9844	0.9529	0.8624	0.6730	0.4727	0.5323	0.8167	0.9676	0.9935	0.9976 (94)
Useful gains	587.2354	666.1829	737.4715	793.8278	769.4707	592.5294	396.9361	415.1856	582.7187	613.3966	572.1655	558.0822 (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	1680.3880	1628.4144	1475.2824	1231.0927	947.6487	627.4029	401.3950	423.2365	677.7638	1032.7883	1378.5132	1671.7991 (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	813.3056	646.6195	548.9313	314.8307	132.5644	0.0000	0.0000	0.0000	0.0000	312.0274	580.5703	828.6053 (98)

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Space heating
Space heating per m2 4177.4547 (98)
(98) / (4) = 39.6493 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4467.8660 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	813.3056	646.6195	548.9313	314.8307	132.5644	0.0000	0.0000	0.0000	0.0000	312.0274	580.5703	828.6053	(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)	869.8455	691.5717	587.0923	336.7173	141.7802	0.0000	0.0000	0.0000	0.0000	333.7192	620.9308	886.2089	(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	212.0232	186.8214	196.0703	175.5791	171.9279	153.4315	147.1716	161.7452	161.5386	182.0745	192.7576	206.8596	(64)
Efficiency of water heater	88.0584	87.8593	87.4152	86.3545	84.1305	79.8000	79.8000	79.8000	79.8000	86.2389	87.5732	79.8000	(216)
(217)m	88.0584	87.8593	87.4152	86.3545	84.1305	79.8000	79.8000	79.8000	79.8000	86.2389	87.5732	88.1390	(217)
Fuel for water heating, kWh/month	240.7756	212.6370	224.2976	203.3237	204.3585	192.2701	184.4256	202.6882	202.4293	211.1279	220.1104	234.6970	(219)
Water heating fuel used	240.7756	212.6370	224.2976	203.3237	204.3585	192.2701	184.4256	202.6882	202.4293	211.1279	220.1104	2533.1410	(219)
Annual totals kWh/year													
Space heating fuel - main system												4467.8660	(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)												450.9135	(232)
Total delivered energy for all uses												7526.9204	(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	4467.8660	0.2160	965.0590 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2533.1410	0.2160	547.1584 (264)
Space and water heating			1512.2175 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	450.9135	0.5190	234.0241 (268)
Total CO2, kg/m2/year			1785.1666 (272)
Emissions per m2 for space and water heating			14.3529 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2212 (272b)
Emissions per m2 for pumps and fans			0.3694 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3529 * 1.00) + 2.2212 + 0.3694, rounded to 2 d.p.			16.9400 (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	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1504 (8)
Pressure test					Yes
Measured/design AP50					4.5200
Infiltration rate					0.3764 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3200 (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	0.4080	0.4000	0.3920	0.3520	0.3440	0.3040	0.3040	0.2960	0.3200	0.3440	0.3600	0.3760 (22b)
Effective ac	0.5832	0.5800	0.5768	0.5619	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5648	0.5707 (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)			8.6700	1.3258	11.4943		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)
140mm Timber Frame	84.3300	13.9900	70.3400	0.1900	13.3646	9.0000	633.0600 (29a)
Timber Wall to Loft	8.4800		8.4800	0.1900	1.6112	9.0000	76.3200 (29a)
Timber Wall to Garage	14.8000		14.8000	0.1900	2.8120	9.0000	133.2000 (29a)
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)
Total net area of external elements Aum(A, m ²)			219.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.4526		(33)
Timebr Frame			75.3600	0.0000	0.0000	20.0000	1507.2000 (32)
Timber GF			69.8900			9.0000	629.0100 (32c)
Timber FF			98.3300			9.0000	884.9700 (32c)
Timber 2F			30.4100			9.0000	273.6900 (32c)
Internal Floor			41.2000			18.0000	741.6000 (32d)
Internal Floor 2			22.9600			18.0000	413.2800 (32d)
Internal Ceiling			41.2000			9.0000	370.8000 (32e)
Internal Ceiling 2			22.9600			9.0000	206.6400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9579.8700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 90.9251 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.0106 (36)
Total fabric heat loss (33) + (36) = 72.4633 (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	51.1776	50.8940	50.6161	49.3107	49.0664	47.9294	47.9294	47.7189	48.3674	49.0664	49.5605	50.0771 (38)
Heat transfer coeff	123.6408	123.3573	123.0793	121.7739	121.5297	120.3927	120.3927	120.1821	120.8306	121.5297	122.0238	122.5403 (39)
Average = Sum(39)m / 12 =												121.7727 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1735	1.1708	1.1682	1.1558	1.1535	1.1427	1.1427	1.1407	1.1468	1.1535	1.1582	1.1631 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7839 (42)											
Average daily hot water use (litres/day)	100.3180 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1578.3921 (45)											
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.7747	30.4141	31.3847	27.3619	26.2544	22.6556	20.9937	24.0906	24.3783	28.4106	31.0124	33.6774 (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	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5326	22.6778	18.4428	13.9624	10.4371	8.8114	9.5210	12.3758	16.6108	21.0912	24.6166	26.2422 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.7132	267.4601	260.5380	245.8017	227.1998	209.7166	198.0367	195.2898	202.2119	216.9482	235.5501	253.0333 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	46.7401	45.2591	42.1837	38.0027	35.2882	31.4661	28.2174	32.3798	33.8588	38.1862	43.0727	45.2653 (72)
Total internal gains	401.7446	400.1558	385.9233	362.5255	337.6837	314.7528	300.5338	304.8042	317.4402	340.9844	367.9981	389.2996 (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		
Southeast				7.0100	36.7938		0.7200	0.7000	0.7700	90.0859 (77)		
Northwest				1.6600	11.2829		0.7200	0.7000	0.7700	6.5418 (81)		
Northwest				4.5100	11.2829		0.7200	0.7000	0.7700	17.7731 (81)		
Northwest				0.8400	17.4137		0.6300	0.7000	1.0000	5.8057 (82)		
Solar gains	120.2064	215.0687	321.7525	444.8908	540.6164	555.3435	527.6526	453.3682	363.9333	245.0987	145.8553	101.6591 (83)
Total gains	521.9510	615.2245	707.6758	807.4163	878.3001	870.0963	828.1864	758.1724	681.3735	586.0831	513.8535	490.9587 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.5226	21.5721	21.6208	21.8526	21.8965	22.1033	22.1033	22.1420	22.0232	21.8965	21.8078	21.7159
alpha	2.4348	2.4381	2.4414	2.4568	2.4598	2.4736	2.4736	2.4761	2.4682	2.4598	2.4539	2.4477
util living area	0.9735	0.9596	0.9342	0.8821	0.7941	0.6677	0.5428	0.5936	0.7794	0.9129	0.9622	0.9770 (86)
MIT	18.2318	18.5157	18.9981	19.6376	20.2247	20.6591	20.8558	20.8150	20.4565	19.6944	18.8510	18.1814 (87)
Th 2	19.9413	19.9434	19.9455	19.9555	19.9574	19.9661	19.9661	19.9677	19.9628	19.9574	19.9536	19.9497 (88)
util rest of house	0.9696	0.9537	0.9240	0.8625	0.7566	0.6005	0.4428	0.4961	0.7254	0.8944	0.9556	0.9736 (89)
MIT 2	17.4022	17.6846	18.1620	18.7924	19.3502	19.7439	19.8968	19.8729	19.5782	18.8594	18.0269	17.3578 (90)
Living area fraction	17.4698	17.7523	18.2302	18.8613	19.4215	19.8185	19.9750	19.9497	19.6498	18.9274	18.0941	17.4250 (92)
MIT	17.4698	17.7523	18.2302	18.8613	19.4215	19.8185	19.9750	19.9497	19.6498	18.9274	18.0941	17.4250 (93)
Temperature adjustment	17.4698	17.7523	18.2302	18.8613	19.4215	19.8185	19.9750	19.9497	19.6498	18.9274	18.0941	17.4250 (93)
adjusted MIT	17.4698	17.7523	18.2302	18.8613	19.4215	19.8185	19.9750	19.9497	19.6498	18.9274	18.0941	17.4250 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	499.2776	576.2759	638.4431	675.8922	644.7513	513.0627	367.4919	374.6531	481.0279	510.2747	482.6284	472.2528 (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	1628.3271	1585.4302	1443.7466	1213.0323	938.3935	628.2670	406.3249	426.6151	670.5888	1012.0299	1341.5423	1620.5945 (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	840.0128	678.1517	599.1458	386.7409	218.4698	0.0000	0.0000	0.0000	0.0000	373.3059	618.4180	854.3662 (98)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space heating
Space heating per m2

(98) / (4) = 4568.6111 (98)
43.3619 (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	1131.6913	890.9060	913.3843	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7072	0.7727	0.7397	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	800.3473	688.3901	675.6166	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1116.2845	1065.6472	987.9061	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	227.4747	280.6792	232.3434	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									fC = cooled area / (4) =				740.4974 (104)
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	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	56.8687	70.1698	58.0858	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling													
Space cooling per m2													185.1243 (107)
Energy for space heating													1.7571 (108)
Energy for space cooling													43.3619 (99)
Total													1.7571 (108)
Dwelling Fabric Energy Efficiency (DFEE)													45.1190 (109)
													45.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1504 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4004 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3404 (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	0.4340	0.4255	0.4169	0.3744	0.3659	0.3233	0.3233	0.3148	0.3404	0.3659	0.3829	0.3999 (22b)
Effective ac	0.5942	0.5905	0.5869	0.5701	0.5669	0.5523	0.5523	0.5496	0.5579	0.5669	0.5733	0.5800 (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)			13.1800	1.3258	17.4735		(27)
TER Room Window (Uw = 1.70)			0.8400	1.5918	1.3371		(27a)
150mm EPS B&B			41.2000	0.1300	5.3560		(28a)
140mm Timber Frame	84.3300	13.9900	70.3400	0.1800	12.6612		(29a)
Timber Wall to Loft	8.4800		8.4800	0.1800	1.5264		(29a)
Timber Wall to Garage	14.8000		14.8000	0.1800	2.6640		(29a)
Wall to Void	22.6400		22.6400	0.1800	4.0752		(29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.1800	0.6984		(29a)
400mm Mineral Wool	11.0300		11.0300	0.1300	1.4339		(30)
Sloping	11.1900	0.8400	10.3500	0.1300	1.3455		(30)
C2V	18.2400		18.2400	0.1300	2.3712		(30)
Dormer Roof	2.7600		2.7600	0.1300	0.3588		(30)
Total net area of external elements Aum(A, m ²)			219.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.4212		(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)							13.4453 (36)
Total fabric heat loss						(33) + (36) =	66.8665 (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	52.1384	51.8175	51.5030	50.0258	49.7494	48.4628	48.4628	48.2246	48.9584	49.7494	50.3085	50.8931 (38)
Heat transfer coeff	119.0048	118.6840	118.3695	116.8923	116.6159	115.3293	115.3293	115.0911	115.8249	116.6159	117.1750	117.7595 (39)
Average = Sum(39)m / 12 =												116.8910 (39)
HLP	1.1295	1.1265	1.1235	1.1095	1.1068	1.0946	1.0946	1.0924	1.0993	1.1068	1.1121	1.1177 (40)
HLP (average)												1.1094 (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												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1578.3921 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.7747	30.4141	31.3847	27.3619	26.2544	22.6556	20.9937	24.0906	24.3783	28.4106	31.0124	33.6774 (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	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5326	22.6778	18.4428	13.9624	10.4371	8.8114	9.5210	12.3758	16.6108	21.0912	24.6166	26.2422	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.7132	267.4601	260.5380	245.8017	227.1998	209.7166	198.0367	195.2898	202.2119	216.9482	235.5501	253.0333	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	(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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	(71)
Water heating gains (Table 5)	46.7401	45.2591	42.1837	38.0027	35.2882	31.4661	28.2174	32.3798	33.8588	38.1862	43.0727	45.2653	(72)
Total internal gains	401.7446	400.1558	385.9233	362.5255	337.6837	314.7528	300.5338	304.8042	317.4402	340.9844	367.9981	389.2996	(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			

Southeast				7.0100	36.7938	0.6300	0.7000	0.7700	78.8252 (77)			
Northwest				6.1700	11.2829	0.6300	0.7000	0.7700	21.2755 (81)			
Northwest				0.8400	17.4137	0.6300	0.7000	1.0000	5.8057 (82)			

Solar gains	105.9063	189.7008	284.3615	394.0669	479.5868	492.9507	468.2502	401.8556	321.9339	216.3387	128.5433	89.5401 (83)
Total gains	507.6509	589.8566	670.2848	756.5924	817.2705	807.7035	768.7840	706.6598	639.3740	557.3231	496.5414	478.8397 (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	61.4821	61.6483	61.8121	62.5932	62.7416	63.4415	63.4415	63.5729	63.1701	62.7416	62.4422	62.1323	
alpha	5.0988	5.1099	5.1208	5.1729	5.1828	5.2294	5.2294	5.2382	5.2113	5.1828	5.1628	5.1422	
util living area	0.9993	0.9983	0.9950	0.9813	0.9312	0.7994	0.6324	0.6996	0.9166	0.9903	0.9985	0.9995	(86)
MIT	19.6757	19.8166	20.0600	20.3966	20.7093	20.9168	20.9809	20.9684	20.8083	20.4062	19.9831	19.6552	(87)
Th 2	19.9768	19.9793	19.9817	19.9931	19.9953	20.0052	20.0052	20.0071	20.0014	19.9953	19.9909	19.9864	(88)
util rest of house	0.9990	0.9977	0.9931	0.9734	0.9000	0.7150	0.5033	0.5720	0.8657	0.9850	0.9978	0.9993	(89)
MIT 2	18.7614	18.9040	19.1486	19.4900	19.7870	19.9640	20.0000	19.9972	19.8844	19.5041	19.0799	18.7486	(90)
Living area fraction									fLA = Living area / (4) =			0.0815	(91)
MIT	18.8359	18.9784	19.2229	19.5639	19.8622	20.0416	20.0800	20.0764	19.9597	19.5776	19.1535	18.8225	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8359	18.9784	19.2229	19.5639	19.8622	20.0416	20.0800	20.0764	19.9597	19.5776	19.1535	18.8225	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	506.9589	587.9872	664.3519	733.0420	731.3483	580.3714	394.8205	411.0652	551.7539	547.1880	495.0805	478.3603	(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	1729.8448	1670.8766	1506.0014	1246.5302	951.8386	627.5801	401.3416	423.1200	678.6996	1046.9360	1412.3709	1721.9388	(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	909.8271	727.7017	626.1872	369.7115	164.0448	0.0000	0.0000	0.0000	0.0000	371.8124	660.4491	925.2224	(98)
Space heating												4754.9562	(98)
Space heating per m2												(98) / (4) =	45.1306 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1084.0955	853.4369	874.6920	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8230	0.8968	0.8633	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	892.1802	765.3689	755.1544	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1043.3578	996.2158	927.6966	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	108.8479	171.7501	128.3714	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												408.9693	(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	27.2120	42.9375	32.0928	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												102.2423	(107)
Space cooling per m2												0.9704	(108)
Energy for space heating												45.1306	(99)
Energy for space cooling												0.9704	(108)
Total												46.1010	(109)
Target Fabric Energy Efficiency (TFEE)												53.0	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (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					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					4.5200
Infiltration rate					0.2260 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1921 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.2113	0.1969	0.1969	0.1873	0.1873	0.1777	0.1777	0.1681	0.1681	0.1825	0.1777	0.1873 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
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)			8.6700	1.3258	11.4943		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)
140mm Timber Frame	84.3300	13.9900	70.3400	0.1900	13.3646	9.0000	633.0600 (29a)
Timber Wall to Loft	8.4800		8.4800	0.1900	1.6112	9.0000	76.3200 (29a)
Timber Wall to Garage	14.8000		14.8000	0.1900	2.8120	9.0000	133.2000 (29a)
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)
Total net area of external elements Aum(A, m ²)			219.8600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	57.4526	(33)
Timebr Frame			75.3600	0.0000	0.0000	20.0000	1507.2000 (32)
Timber GF			69.8900			9.0000	629.0100 (32c)
Timber FF			98.3300			9.0000	884.9700 (32c)
Timber 2F			30.4100			9.0000	273.6900 (32c)
Internal Floor			41.2000			18.0000	741.6000 (32d)
Internal Floor 2			22.9600			18.0000	413.2800 (32d)
Internal Ceiling			41.2000			18.0000	741.6000 (32e)
Internal Ceiling 2			22.9600			18.0000	413.2800 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10157.3100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							96.4058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0106 (36)
Total fabric heat loss					(33) + (36) =		72.4633 (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	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756 (38)
Heat transfer coeff	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389 (39)
Average = Sum(39)m / 12 =												116.3389 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042 (40)
HLP (average)												1.1042 (40)
Days in month												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Energy content (annual)												1578.3921 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (64)
RHI water heating demand												2088.8081 (64)
Heat gains from water heating, kWh/month	89.0924	78.9134	83.7881	76.3750	75.7608	69.0109	67.5293	72.3750	71.7065	79.1345	82.0868	87.3756 (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	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.8315	56.6945	46.1071	34.9060	26.0927	22.0285	23.8026	30.9395	41.5270	52.7280	61.5414	65.6055 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	119.7479	117.4306	112.6184	106.0763	101.8290	95.8485	90.7652	97.2782	99.5923	106.3636	114.0095	117.4403 (72)
Total internal gains	691.8394	686.4850	660.7539	621.0163	580.1915	544.0525	523.3107	532.8608	556.0938	596.0606	640.2839	673.8732 (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	
Southeast			7.0100		45.1778		0.7200		0.7000		0.7700	110.6132 (77)
Northwest			1.6600		14.6176		0.7200		0.7000		0.7700	8.4752 (81)
Northwest			4.5100		14.6176		0.7200		0.7000		0.7700	23.0260 (81)
Northwest			0.8400		22.7413		0.6300		0.7000		1.0000	7.5819 (82)
Solar gains	149.6962	228.8198	347.3774	486.5138	560.9785	632.3472	579.4708	518.4277	413.1109	278.4369	181.2279	119.7318 (83)
Total gains	841.5356	915.3048	1008.1313	1107.5301	1141.1699	1176.3997	1102.7814	1051.2885	969.2047	874.4975	821.5119	793.6050 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522
alpha	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168
util living area	0.9235	0.9039	0.8577	0.7735	0.6415	0.4588	0.3335	0.3481	0.5770	0.7851	0.8898	0.9311 (86)
MIT	19.1718	19.3628	19.7768	20.2548	20.6705	20.9057	20.9715	20.9684	20.8169	20.3649	19.7054	19.1249 (87)
Th 2	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974 (88)
util rest of house	0.9128	0.8907	0.8376	0.7410	0.5879	0.3816	0.2378	0.2489	0.5010	0.7455	0.8719	0.9212 (89)
MIT 2	17.5974	17.8691	18.4547	19.1138	19.6578	19.9259	19.9845	19.9830	19.8403	19.2790	18.3643	17.5318 (90)
Living area fraction	17.7258	17.9909	18.5625	19.2068	19.7404	20.0058	20.0650	20.0634	19.9199	19.3675	18.4736	17.6617 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5758	17.8409	18.4125	19.0568	19.5904	19.8558	19.9150	19.9134	19.7699	19.2175	18.3236	17.5117 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8775	0.8530	0.7981	0.7052	0.5637	0.3701	0.2297	0.2402	0.4821	0.7087	0.8328	0.8871	(94)
Useful gains	738.4125	780.7629	804.5408	781.0790	643.2873	435.3398	253.2681	252.5708	467.2127	619.7196	684.1227	704.0174	(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													
	1416.5185	1389.1881	1257.9142	1053.6627	755.0863	460.2075	257.6893	257.4993	520.0263	839.6745	1154.5019	1397.4294	(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													
	504.5108	408.8617	337.3098	196.2603	83.1784	0.0000	0.0000	0.0000	0.0000	163.6464	338.6730	515.8986	(98)
Space heating												2548.3391	(98)
RHI space heating demand												2548	(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	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					0.0000 / (5) = 0.0000 (8)
Measured/design AP50					Yes
Infiltration rate					4.5200
Number of sides sheltered					0.2260 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1921 (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	0.2449	0.2401	0.2353	0.2113	0.2065	0.1825	0.1825	0.1777	0.1921	0.2065	0.2161	0.2257 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
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)			8.6700	1.3258	11.4943		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)
140mm Timber Frame	84.3300	13.9900	70.3400	0.1900	13.3646	9.0000	633.0600 (29a)
Timber Wall to Loft	8.4800		8.4800	0.1900	1.6112	9.0000	76.3200 (29a)
Timber Wall to Garage	14.8000		14.8000	0.1900	2.8120	9.0000	133.2000 (29a)
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)
Total net area of external elements Aum(A, m ²)			219.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.4526		(33)
Timber Frame			75.3600	0.0000	0.0000	20.0000	1507.2000 (32)
Timber GF			69.8900			9.0000	629.0100 (32c)
Timber FF			98.3300			9.0000	884.9700 (32c)
Timber 2F			30.4100			9.0000	273.6900 (32c)
Internal Floor			41.2000			18.0000	741.6000 (32d)
Internal Floor 2			22.9600			18.0000	413.2800 (32d)
Internal Ceiling			41.2000			18.0000	741.6000 (32e)
Internal Ceiling 2			22.9600			18.0000	413.2800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss (33) + (36) = 72.4633 (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	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756 (38)
Heat transfer coeff	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389 (39)
Average = Sum(39)m / 12 =												116.3389 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042 (40)
HLP (average)												1.1042 (40)
Days in month												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy content	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Distribution loss (46)m = 0.15 x (45)m												1578.3921 (46)
24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (46)	
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss												
20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)	
If cylinder contains dedicated solar storage												
20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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												
206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h												
206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (64)	
Total per year (kWh/year) = Sum (64)m =												2088.8081 (64)
Heat gains from water heating, kWh/month												
89.0924	78.9134	83.7881	76.3750	75.7608	69.0109	67.5293	72.3750	71.7065	79.1345	82.0868	87.3756 (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	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
63.8315	56.6945	46.1071	34.9060	26.0927	22.0285	23.8026	30.9395	41.5270	52.7280	61.5414	65.6055 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (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)												
-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)	
Water heating gains (Table 5)												
119.7479	117.4306	112.6184	106.0763	101.8290	95.8485	90.7652	97.2782	99.5923	106.3636	114.0095	117.4403 (72)	
Total internal gains												
691.8394	686.4850	660.7539	621.0163	580.1915	544.0525	523.3107	532.8608	556.0938	596.0606	640.2839	673.8732 (73)	

6. Solar gains												

[Jan]												
	Area											
	m2											
	Solar flux											
	Table 6a											
	W/m2											
	Specific data											
	or Table 6b											
	Specific data											
	or Table 6c											
	Access											
	factor											
	Table 6d											
	Gains											
	W											
Southeast	7.0100											90.0859 (77)
Northwest	1.6600											6.5418 (81)
Northwest	4.5100											17.7731 (81)
Northwest	0.8400											5.8057 (82)
Solar gains	120.2064	215.0687	321.7525	444.8908	540.6164	555.3435	527.6526	453.3682	363.9333	245.0987	145.8553	101.6591 (83)
Total gains	812.0458	901.5537	982.5064	1065.9071	1120.8078	1099.3960	1050.9632	986.2290	920.0271	841.1593	786.1393	775.5323 (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	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	
alpha	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	
util living area												
0.9380	0.9176	0.8818	0.8151	0.7106	0.5729	0.4460	0.4863	0.6726	0.8391	0.9160	0.9443 (86)	
MIT	18.9191	19.1576	19.5544	20.0507	20.4971	20.7980	20.9239	20.9022	20.6759	20.1118	19.4197	18.8469 (87)
Th 2	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974 (88)
util rest of house												
0.9296	0.9066	0.8656	0.7888	0.6676	0.5060	0.3574	0.3972	0.6112	0.8104	0.9029	0.9368 (89)	
MIT 2	17.2331	17.5744	18.1401	18.8354	19.4373	19.8126	19.9467	19.9283	19.6780	18.9354	17.9573	17.1297 (90)
Living area fraction												
fLA = Living area / (4) =												0.0815 (91)
MIT	17.3706	17.7035	18.2554	18.9345	19.5237	19.8929	20.0264	20.0077	19.7593	19.0313	18.0765	17.2697 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2206	17.5535	18.1054	18.7845	19.3737	19.7429	19.8764	19.8577	19.6093	18.8813	17.9265	17.1197 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8971	0.8706	0.8265	0.7504	0.6372	0.4875	0.3460	0.3838	0.5842	0.7706	0.8662	0.9057	(94)
Useful gains	728.5087	784.8993	812.0745	799.8295	714.1478	535.9112	363.6272	378.5498	537.4415	648.2245	680.9527	702.4096	(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	1503.1630	1472.0945	1350.1593	1149.9537	892.7482	598.3199	381.1689	402.2666	640.9487	963.4349	1259.5435	1503.0676	(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	576.3428	461.7951	400.3351	252.0894	132.8787	0.0000	0.0000	0.0000	0.0000	234.5165	416.5853	595.6895	(98)
Space heating												3070.2325	(98)
Space heating per m2												29.1404	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3388.7776 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	576.3428	461.7951	400.3351	252.0894	132.8787	0.0000	0.0000	0.0000	0.0000	234.5165	416.5853	595.6895	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	636.1400	509.7076	441.8709	278.2444	146.6652	0.0000	0.0000	0.0000	0.0000	258.8483	459.8072	657.4939	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323	(64)
Efficiency of water heater	87.5035	87.2916	86.8430	85.9524	84.3137	79.9000	79.9000	79.9000	79.9000	85.6649	86.9794	79.9000	(216)
(217)m	87.5035	87.2916	86.8430	85.9524	84.3137	79.9000	79.9000	79.9000	79.9000	85.6649	86.9794	79.9000	(217)
Fuel for water heating, kWh/month	236.5573	208.8179	219.9866	198.6145	197.9518	185.9404	177.9028	196.1425	196.0869	206.6740	216.0196	230.3230	(219)
Water heating fuel used												2471.0174	(219)
Annual totals kWh/year													
Space heating fuel - main system												3388.7776	(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)													74.4310 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													149.4310 (231)
Electricity for lighting (calculated in Appendix L)													450.9135 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.68 * 1029 * 1.00) =													-559.8776 (233)
Total delivered energy for all uses													5900.2619 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3388.7776	3.4800	117.9295	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2471.0174	3.4800	85.9914	(247)
Mechanical ventilation fans	74.4310	13.1900	9.8174	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	450.9135	13.1900	59.4755	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-559.8776	13.1900	-73.8479	(252)
Total energy cost			329.2584	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9197 (257)
SAP value		87.1700
SAP rating (Section 12)		87 (258)
SAP band		B

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CALCULATION OF ENERGY RATINGS 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	3388.7776	0.2160	731.9760 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2471.0174	0.2160	533.7398 (264)
Space and water heating			1265.7157 (265)
Pumps and fans	149.4310	0.5190	77.5547 (267)
Energy for lighting	450.9135	0.5190	234.0241 (268)
Energy saving/generation technologies			
PV Unit	-559.8776	0.5190	-290.5765 (269)
Total kg/year			1286.7180 (272)
CO2 emissions per m2			12.2100 (273)
EI value			88.5328
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9060 = 3.841$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9060 = 0.2384$, stars = 4
Water heating energy efficiency	$3.48 / 0.8431 = 4.127$, stars = 4
Water heating environmental impact	$0.216 / 0.8431 = 0.2562$, 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	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.5200
Infiltration rate					0.2260 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.1921 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.2113	0.1969	0.1969	0.1873	0.1873	0.1777	0.1777	0.1681	0.1681	0.1825	0.1777	0.1873 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
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)			8.6700	1.3258	11.4943		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)
140mm Timber Frame	84.3300	13.9900	70.3400	0.1900	13.3646	9.0000	633.0600 (29a)
Timber Wall to Loft	8.4800		8.4800	0.1900	1.6112	9.0000	76.3200 (29a)
Timber Wall to Garage	14.8000		14.8000	0.1900	2.8120	9.0000	133.2000 (29a)
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)
Total net area of external elements Aum(A, m ²)			219.8600				(31)
Fabric heat loss, W/K = Sum (A x U)							
				(26)...(30) + (32) =		57.4526	
Timber Frame			75.3600	0.0000	0.0000	20.0000	1507.2000 (32)
Timber GF			69.8900			9.0000	629.0100 (32c)
Timber FF			98.3300			9.0000	884.9700 (32c)
Timber 2F			30.4100			9.0000	273.6900 (32c)
Internal Floor			41.2000			18.0000	741.6000 (32d)
Internal Floor 2			22.9600			18.0000	413.2800 (32d)
Internal Ceiling			41.2000			18.0000	741.6000 (32e)
Internal Ceiling 2			22.9600			18.0000	413.2800 (32e)
Heat capacity Cm = Sum(A x k)							
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							
Total fabric heat loss							
						(33) + (36) =	
						72.4633 (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	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756 (38)
Heat transfer coeff	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389 (39)
Average = Sum(39)m / 12 =												116.3389 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042 (40)
HLP (average)												1.1042 (40)
Days in month												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy content	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Distribution loss (46)m = 0.15 x (45)m												1578.3921 (46)
24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (46)	
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss												
20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)	
If cylinder contains dedicated solar storage												
20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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												
206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h												
206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (64)	
Total per year (kWh/year) = Sum (64)m =												2088.8081 (64)
Heat gains from water heating, kWh/month												
89.0924	78.9134	83.7881	76.3750	75.7608	69.0109	67.5293	72.3750	71.7065	79.1345	82.0868	87.3756 (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	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
63.8315	56.6945	46.1071	34.9060	26.0927	22.0285	23.8026	30.9395	41.5270	52.7280	61.5414	65.6055 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (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)												
-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)	
Water heating gains (Table 5)												
119.7479	117.4306	112.6184	106.0763	101.8290	95.8485	90.7652	97.2782	99.5923	106.3636	114.0095	117.4403 (72)	
Total internal gains												
691.8394	686.4850	660.7539	621.0163	580.1915	544.0525	523.3107	532.8608	556.0938	596.0606	640.2839	673.8732 (73)	

6. Solar gains												

[Jan]			Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
Southeast			7.0100		45.1778		0.7200		0.7000		0.7700	110.6132 (77)
Northwest			1.6600		14.6176		0.7200		0.7000		0.7700	8.4752 (81)
Northwest			4.5100		14.6176		0.7200		0.7000		0.7700	23.0260 (81)
Northwest			0.8400		22.7413		0.6300		0.7000		1.0000	7.5819 (82)
Solar gains	149.6962	228.8198	347.3774	486.5138	560.9785	632.3472	579.4708	518.4277	413.1109	278.4369	181.2279	119.7318 (83)
Total gains	841.5356	915.3048	1008.1313	1107.5301	1141.1699	1176.3997	1102.7814	1051.2885	969.2047	874.4975	821.5119	793.6050 (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	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522
alpha	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168
util living area												
0.9235	0.9039	0.8577	0.7735	0.6415	0.4588	0.3335	0.3481	0.5770	0.7851	0.8898	0.9311 (86)	
MIT	19.1718	19.3628	19.7768	20.2548	20.6705	20.9057	20.9715	20.9684	20.8169	20.3649	19.7054	19.1249 (87)
Th 2	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974 (88)
util rest of house												
0.9128	0.8907	0.8376	0.7410	0.5879	0.3816	0.2378	0.2489	0.5010	0.7455	0.8719	0.9212 (89)	
MIT 2	17.5974	17.8691	18.4547	19.1138	19.6578	19.9259	19.9845	19.9830	19.8403	19.2790	18.3643	17.5318 (90)
Living area fraction												
fLA = Living area / (4) =												0.0815 (91)
MIT	17.7258	17.9909	18.5625	19.2068	19.7404	20.0058	20.0650	20.0634	19.9199	19.3675	18.4736	17.6617 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5758	17.8409	18.4125	19.0568	19.5904	19.8558	19.9150	19.9134	19.7699	19.2175	18.3236	17.5117 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8775	0.8530	0.7981	0.7052	0.5637	0.3701	0.2297	0.2402	0.4821	0.7087	0.8328	0.8871	(94)
Useful gains	738.4125	780.7629	804.5408	781.0790	643.2873	435.3398	253.2681	252.5708	467.2127	619.7196	684.1227	704.0174	(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	1416.5185	1389.1881	1257.9142	1053.6627	755.0863	460.2075	257.6893	257.4993	520.0263	839.6745	1154.5019	1397.4294	(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	504.5108	408.8617	337.3098	196.2603	83.1784	0.0000	0.0000	0.0000	0.0000	163.6464	338.6730	515.8986	(98)
Space heating												2548.3391	(98)
Space heating per m2												24.1870	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2812.7363 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	504.5108	408.8617	337.3098	196.2603	83.1784	0.0000	0.0000	0.0000	0.0000	163.6464	338.6730	515.8986	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	556.8552	451.2823	372.3067	216.6228	91.8084	0.0000	0.0000	0.0000	0.0000	180.6252	373.8112	569.4244	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323	(64)
Efficiency of water heater	87.2026	87.0071	86.4156	85.2868	83.1669	79.9000	79.9000	79.9000	79.9000	84.7052	86.4681	79.9000	(216)
(217)m	87.2026	87.0071	86.4156	85.2868	83.1669	79.9000	79.9000	79.9000	79.9000	84.7052	86.4681	79.9000	(217)
Fuel for water heating, kWh/month	237.3736	209.5007	221.0747	200.1645	200.6814	185.9404	177.9028	196.1425	196.0869	209.0158	217.2969	231.1623	(219)
Water heating fuel used												2482.3427	(219)
Annual totals kWh/year												2812.7363	(211)
Space heating fuel - main system												0.0000	(215)
Space heating fuel - secondary													
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)													74.4310 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													149.4310 (231)
Electricity for lighting (calculated in Appendix L)													450.9135 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.68 * 1149 * 1.00) =													-625.0681 (233)
Total delivered energy for all uses													5270.3553 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2812.7363	7.6100	214.0492	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2482.3427	7.6100	188.9063	(247)
Mechanical ventilation fans	74.4310	31.0800	23.1332	(249)
Pumps and fans for heating	75.0000	31.0800	23.3100	(249)
Energy for lighting	450.9135	31.0800	140.1439	(250)
Additional standing charges			105.0000	(251)
Energy saving/generation technologies				
PV Unit	-625.0681	31.0800	-194.2712	(252)
Total energy cost			500.2714	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2812.7363	0.2160	607.5510	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2482.3427	0.2160	536.1860	(264)
Space and water heating			1143.7371	(265)
Pumps and fans	149.4310	0.5190	77.5547	(267)
Energy for lighting	450.9135	0.5190	234.0241	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Energy saving/generation technologies			
PV Unit	-625.0681	0.5190	-324.4104 (269)
Total kg/year			1130.9055 (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	2812.7363	1.2200	3431.5383 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2482.3427	1.2200	3028.4581 (264)
Space and water heating			6459.9964 (265)
Pumps and fans	149.4310	3.0700	458.7532 (267)
Energy for lighting	450.9135	3.0700	1384.3043 (268)
Energy saving/generation technologies			
PV Unit	-625.0681	3.0700	-1918.9592 (269)
Primary energy kWh/year			6384.0947 (272)
Primary energy kWh/m2/year			60.5932 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	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	-£ 86	-261 kg (23.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£86	2.48 kg/m²	B 89
Total Savings	£86	2.48 kg/m²	B 91

Potential energy efficiency rating:	B 89
Potential environmental impact rating:	B 91

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

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

	Current	Potential	Saving
Electricity	£187	£202	-£16
Mains gas	£508	£407	£101
Space heating	£365	£367	-£2
Water heating	£189	£102	£87
Lighting	£140	£140	£0
Generated (PV)	-£194	-£194	£0
Total cost of fuels	£501	£415	£85
Total cost of uses	£500	£415	£85

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Delivered energy	50 kWh/m ²	38 kWh/m ²	12 kWh/m ²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.3 tonnes
CO2 emissions per m ²	11 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	61 kWh/m ²	47 kWh/m ²	14 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					0.0000 / (5) = 0.0000 (8)
Measured/design AP50					Yes
Infiltration rate					4.5200
Number of sides sheltered					0.2260 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1921 (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	0.2449	0.2401	0.2353	0.2113	0.2065	0.1825	0.1825	0.1777	0.1921	0.2065	0.2161	0.2257 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
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)			8.6700	1.3258	11.4943		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)
140mm Timber Frame	84.3300	13.9900	70.3400	0.1900	13.3646	9.0000	633.0600 (29a)
Timber Wall to Loft	8.4800		8.4800	0.1900	1.6112	9.0000	76.3200 (29a)
Timber Wall to Garage	14.8000		14.8000	0.1900	2.8120	9.0000	133.2000 (29a)
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)
Total net area of external elements Aum(A, m ²)			219.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.4526		(33)
Timber Frame			75.3600	0.0000	0.0000	20.0000	1507.2000 (32)
Timber GF			69.8900			9.0000	629.0100 (32c)
Timber FF			98.3300			9.0000	884.9700 (32c)
Timber 2F			30.4100			9.0000	273.6900 (32c)
Internal Floor			41.2000			18.0000	741.6000 (32d)
Internal Floor 2			22.9600			18.0000	413.2800 (32d)
Internal Ceiling			41.2000			18.0000	741.6000 (32e)
Internal Ceiling 2			22.9600			18.0000	413.2800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss (28)...(30) + (32) + (32a)...(32e) = 10157.3100 (34)
96.4058 (35)
15.0106 (36)
(33) + (36) = 72.4633 (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	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756 (38)
Heat transfer coeff	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389 (39)
Average = Sum(39)m / 12 =												116.3389 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042 (40)
HLP (average)												1.1042 (40)
Days in month												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2924 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6979 (55)
Total storage loss	21.6341	19.5405	21.6341	20.9363	21.6341	20.9363	21.6341	21.6341	20.9363	21.6341	20.9363	21.6341 (56)
If cylinder contains dedicated solar storage	13.0944	11.8272	13.0944	12.6720	13.0944	12.6720	13.0944	13.0944	12.6720	13.0944	12.6720	13.0944 (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	200.0023	175.9638	182.6536	157.1923	147.1126	129.1917	122.1237	137.6278	144.5025	168.6578	181.1244	194.8387 (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												1.1490 (H8)
Utilisation factor												0.5812 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												100.3180 (H14)
Volume ratio Veff/V												1.0915 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-926.7967 (H17)
Solar input	-26.8753	-44.8471	-76.3797	-102.3639	-126.4619	-124.3322	-122.6891	-107.1941	-83.9545	-57.3310	-31.8779	-22.4900 (63)
Output from w/h	173.1270	131.1167	106.2739	54.8285	20.6507	4.8594	0.0000	30.4337	60.5480	111.3268	149.2465	172.3487 (64)
Heat gains from water heating, kWh/month	83.4975	73.8599	77.0766	65.5576	59.9304	53.5111	51.5128	57.1029	61.9697	72.4230	76.6724	81.7806 (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	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.8315	56.6945	46.1071	34.9060	26.0927	22.0285	23.8026	30.9395	41.5270	52.7280	61.5414	65.6055 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	112.2279	109.9105	103.5976	91.0523	80.5516	74.3209	69.2377	76.7513	86.0691	97.3427	106.4894	109.9202 (72)
Total internal gains	684.3193	678.9649	651.7330	605.9922	558.9141	522.5250	501.7832	512.3338	542.5706	587.0397	632.7639	666.3531 (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							
Southeast	7.0100	36.7938	0.7200	0.7000	0.7700	90.0859 (77)						
Northwest	1.6600	11.2829	0.7200	0.7000	0.7700	6.5418 (81)						
Northwest	4.5100	11.2829	0.7200	0.7000	0.7700	17.7731 (81)						
Northwest	0.8400	17.4137	0.6300	0.7000	1.0000	5.8057 (82)						
Solar gains	120.2064	215.0687	321.7525	444.8908	540.6164	555.3435	527.6526	453.3682	363.9333	245.0987	145.8553	101.6591 (83)
Total gains	804.5257	894.0336	973.4856	1050.8830	1099.5305	1077.8685	1029.4357	965.7021	906.5039	832.1384	778.6192	768.0122 (84)

7. Mean internal temperature (heating season)												

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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	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522
alpha	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168
util living area	0.9392	0.9190	0.8837	0.8193	0.7177	0.5808	0.4536	0.4944	0.6782	0.8419	0.9176	0.9455 (86)
MIT	18.9083	19.1476	19.5438	20.0368	20.4841	20.7911	20.9208	20.8983	20.6690	20.1027	19.4097	18.8359 (87)
Th 2	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974 (88)
util rest of house	0.9310	0.9081	0.8678	0.7932	0.6749	0.5137	0.3640	0.4044	0.6170	0.8136	0.9047	0.9380 (89)
MIT 2	17.2178	17.5603	18.1254	18.8170	19.4215	19.8058	19.9444	19.9253	19.6703	18.9233	17.9433	17.1140 (90)
Living area fraction	fLA = Living area / (4) = 0.0815 (91)											
MIT	17.3556	17.6897	18.2410	18.9164	19.5081	19.8861	20.0240	20.0046	19.7518	19.0195	18.0629	17.2544 (92)
Temperature adjustment	-0.1500											
adjusted MIT	17.2056	17.5397	18.0910	18.7664	19.3581	19.7361	19.8740	19.8546	19.6018	18.8695	17.9129	17.1044 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8987	0.8723	0.8288	0.7546	0.6439	0.4945	0.3522	0.3906	0.5895	0.7737	0.8682	0.9072 (94)
Useful gains	723.0216	779.8418	806.7951	793.0285	707.9769	533.0194	362.6027	377.2019	534.3792	643.8437	675.9617	696.7773 (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	1501.4244	1470.4868	1348.4868	1147.8494	890.9398	597.5289	380.8966	401.9052	640.0689	962.0643	1257.9551	1501.2868 (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	579.1317	464.1135	403.0187	255.4711	136.1244	0.0000	0.0000	0.0000	0.0000	236.7561	419.0353	598.5550 (98)
Space heating	3092.2057 (98)											
Space heating per m2	(98) / (4) = 29.3490 (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 %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3413.0306 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	579.1317	464.1135	403.0187	255.4711	136.1244	0.0000	0.0000	0.0000	0.0000	236.7561	419.0353	598.5550 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	639.2182	512.2665	444.8330	281.9769	150.2476	0.0000	0.0000	0.0000	0.0000	261.3202	462.5114	660.6568 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	173.1270	131.1167	106.2739	54.8285	20.6507	4.8594	0.0000	30.4337	60.5480	111.3268	149.2465	172.3487 (64)
Efficiency of water heater	87.8912	88.0040	88.1371	88.5057	89.0295	79.9000	79.9000	79.9000	79.9000	86.8789	87.5218	79.9000 (216)
(217)m	87.8912	88.0040	88.1371	88.5057	89.0295	79.9000	79.9000	79.9000	79.9000	86.8789	87.5218	87.9663 (217)
Fuel for water heating, kWh/month	196.9788	148.9895	120.5780	61.9491	23.1953	6.0819	0.0000	38.0897	75.7798	128.1401	170.5249	195.9257 (219)
Water heating fuel used												1166.2329 (219)
Annual totals kWh/year												
Space heating fuel - main system												3413.0306 (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)												74.4310 (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												199.4310 (231)
Electricity for lighting (calculated in Appendix L)												450.9135 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.68 * 1029 * 1.00) =												-559.8776 (233)
Total delivered energy for all uses												4669.7303 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3413.0306	3.4800	118.7735 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1166.2329	3.4800	40.5849 (247)
Mechanical ventilation fans	74.4310	13.1900	9.8174 (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	450.9135	13.1900	59.4755 (250)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-559.8776	13.1900	-73.8479 (252)
Total energy cost			291.2909 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		$[(255) \times (256)] / [(4) + 45.0] =$	0.8137 (257)
SAP value			88.6494
SAP rating (Section 12)			89 (258)
SAP band			B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3413.0306	0.2160	737.2146 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1166.2329	0.2160	251.9063 (264)
Space and water heating			989.1209 (265)
Pumps and fans	199.4310	0.5190	103.5047 (267)
Energy for lighting	450.9135	0.5190	234.0241 (268)
Energy saving/generation technologies			
PV Unit	-559.8776	0.5190	-290.5765 (269)
Total kg/year			1036.0732 (272)
CO2 emissions per m2			9.8300 (273)
EI value			90.7666
EI rating			91 (274)
EI band			B

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Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							4.5200					
Infiltration rate							0.2260	(18)				
Number of sides sheltered							2	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.8500 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.1921 (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												
	0.2113	0.1969	0.1969	0.1873	0.1873	0.1777	0.1777	0.1681	0.1681	0.1825	0.1777	0.1873 (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)			8.6700	1.3258	11.4943		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)
140mm Timber Frame	84.3300	13.9900	70.3400	0.1900	13.3646	9.0000	633.0600 (29a)
Timber Wall to Loft	8.4800		8.4800	0.1900	1.6112	9.0000	76.3200 (29a)
Timber Wall to Garage	14.8000		14.8000	0.1900	2.8120	9.0000	133.2000 (29a)
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)
Total net area of external elements Aum(A, m ²)			219.8600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	57.4526	(33)
Timebr Frame			75.3600	0.0000	0.0000	20.0000	1507.2000 (32)
Timber GF			69.8900			9.0000	629.0100 (32c)
Timber FF			98.3300			9.0000	884.9700 (32c)
Timber 2F			30.4100			9.0000	273.6900 (32c)
Internal Floor			41.2000			18.0000	741.6000 (32d)
Internal Floor 2			22.9600			18.0000	413.2800 (32d)
Internal Ceiling			41.2000			18.0000	741.6000 (32e)
Internal Ceiling 2			22.9600			18.0000	413.2800 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	10157.3100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K						96.4058	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						15.0106	(36)
Total fabric heat loss					(33) + (36) =	72.4633	(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	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756 (38)
Heat transfer coeff	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389	116.3389 (39)
Average = Sum(39)m / 12 =												116.3389 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042	1.1042 (40)
HLP (average)												1.1042 (40)
Days in month												

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	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Energy content (annual)												1578.3921 (45)
Distribution loss (46)m = 0.15 x (45)m												23.7723 (46)
Water storage loss:												190.0000 (47)
Store volume												1.2924 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.6979 (55)
Enter (49) or (54) in (55)												
Total storage loss	21.6341	19.5405	21.6341	20.9363	21.6341	20.9363	21.6341	21.6341	20.9363	21.6341	20.9363	21.6341 (56)
If cylinder contains dedicated solar storage	13.0944	11.8272	13.0944	12.6720	13.0944	12.6720	13.0944	13.0944	12.6720	13.0944	12.6720	13.0944 (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	200.0023	175.9638	182.6536	157.1923	147.1126	129.1917	122.1237	137.6278	144.5025	168.6578	181.1244	194.8387 (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												1.2779 (H8)
Utilisation factor												0.5428 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												100.3180 (H14)
Volume ratio Veff/V												1.0915 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-962.6010 (H17)
Solar input	-31.6001	-44.9333	-77.2295	-104.2005	-121.7839	-131.3050	-124.9921	-113.9221	-89.0189	-61.2190	-37.3746	-25.0221 (63)
Output from w/h	168.4022	131.0305	105.4241	52.9918	25.3287	0.0000	0.0000	23.7057	55.4836	107.4388	143.7499	169.8166 (64)
Heat gains from water heating, kWh/month	83.4975	73.8599	77.0766	65.5576	59.9304	53.5111	51.5128	57.1029	61.9697	72.4230	76.6724	81.7806 (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	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.8315	56.6945	46.1071	34.9060	26.0927	22.0285	23.8026	30.9395	41.5270	52.7280	61.5414	65.6055 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	112.2279	109.9105	103.5976	91.0523	80.5516	74.3209	69.2377	76.7513	86.0691	97.3427	106.4894	109.9202 (72)
Total internal gains	684.3193	678.9649	651.7330	605.9922	558.9141	522.5250	501.7832	512.3338	542.5706	587.0397	632.7639	666.3531 (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							
Southeast	7.0100	45.1778	0.7200	0.7000	0.7700	110.6132 (77)						
Northwest	1.6600	14.6176	0.7200	0.7000	0.7700	8.4752 (81)						
Northwest	4.5100	14.6176	0.7200	0.7000	0.7700	23.0260 (81)						
Northwest	0.8400	22.7413	0.6300	0.7000	1.0000	7.5819 (82)						
Solar gains	149.6962	228.8198	347.3774	486.5138	560.9785	632.3472	579.4708	518.4277	413.1109	278.4369	181.2279	119.7318 (83)
Total gains	834.0156	907.7847	999.1104	1092.5060	1119.8926	1154.8721	1081.2539	1030.7615	955.6815	865.4767	813.9918	786.0850 (84)

7. Mean internal temperature (heating season)												

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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	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522	24.2522
alpha	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168	2.6168
util living area	0.9248	0.9054	0.8599	0.7780	0.6489	0.4657	0.3395	0.3543	0.5826	0.7884	0.8917	0.9324 (86)
MIT	19.1615	19.3532	19.7671	20.2429	20.6610	20.9022	20.9703	20.9671	20.8126	20.3575	19.6963	19.1144 (87)
Th 2	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974	19.9974 (88)
util rest of house	0.9143	0.8924	0.8400	0.7458	0.5953	0.3878	0.2424	0.2536	0.5065	0.7491	0.8740	0.9227 (89)
MIT 2	17.5830	17.8557	18.4414	19.0986	19.6472	19.9231	19.9839	19.9823	19.8362	19.2696	18.3517	17.5169 (90)
Living area fraction	fLA = Living area / (4) =											0.0815 (91)
MIT	17.7117	17.9778	18.5495	19.1919	19.7298	20.0029	20.0643	20.0626	19.9158	19.3583	18.4614	17.6472 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5617	17.8278	18.3995	19.0419	19.5798	19.8529	19.9143	19.9126	19.7658	19.2083	18.3114	17.4972 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8792	0.8548	0.8004	0.7097	0.5705	0.3759	0.2340	0.2447	0.4870	0.7120	0.8349	0.8888 (94)
Useful gains	733.2459	775.9757	799.7348	775.3337	638.9276	434.0857	252.9891	252.2624	465.4631	616.2291	679.6319	698.6948 (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	1414.8764	1387.6664	1256.4019	1051.9214	753.8555	459.8768	257.6133	257.4151	519.5456	838.6098	1153.0754	1395.7394 (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	507.1331	411.0562	339.7603	199.1431	85.5064	0.0000	0.0000	0.0000	0.0000	165.4512	340.8793	518.6012 (98)
Space heating												2567.5308 (98)
Space heating per m2	(98) / (4) =											24.3691 (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 %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2833.9192 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	507.1331	411.0562	339.7603	199.1431	85.5064	0.0000	0.0000	0.0000	0.0000	165.4512	340.8793	518.6012 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	559.7495	453.7044	375.0114	219.8048	94.3779	0.0000	0.0000	0.0000	0.0000	182.6173	376.2465	572.4075 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	168.4022	131.0305	105.4241	52.9918	25.3287	0.0000	0.0000	23.7057	55.4836	107.4388	143.7499	169.8166 (64)
Efficiency of water heater	87.6731	87.7592	87.8151	88.1198	87.9096	79.9000	79.9000	79.9000	79.9000	86.0624	87.1386	87.7028 (216)
Fuel for water heating, kWh/month	192.0796	149.3067	120.0523	60.1361	28.8122	0.0000	0.0000	29.6692	69.4413	124.8382	164.9669	193.6274 (219)
Water heating fuel used												1132.9298 (219)
Annual totals kWh/year												
Space heating fuel - main system												2833.9192 (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)												74.4310 (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												199.4310 (231)
Electricity for lighting (calculated in Appendix L)												450.9135 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.68 * 1149 * 1.00) =												-625.0681 (233)
Total delivered energy for all uses												3992.1254 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2833.9192	7.6100	215.6613 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1132.9298	7.6100	86.2160 (247)
Mechanical ventilation fans	74.4310	31.0800	23.1332 (249)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Pump for solar water heating	50.0000	31.0800	15.5400 (249)
Energy for lighting	450.9135	31.0800	140.1439 (250)

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Additional standing charges			105.0000 (251)
Energy saving/generation technologies			
PV Unit	-625.0681	31.0800	-194.2712 (252)
Total energy cost			414.7331 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2833.9192	0.2160	612.1266 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1132.9298	0.2160	244.7128 (264)
Space and water heating			856.8394 (265)
Pumps and fans	199.4310	0.5190	103.5047 (267)
Energy for lighting	450.9135	0.5190	234.0241 (268)
Energy saving/generation technologies			
PV Unit	-625.0681	0.5190	-324.4104 (269)
Total kg/year			869.9578 (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	2833.9192	1.2200	3457.3815 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1132.9298	1.2200	1382.1744 (264)
Space and water heating			4839.5558 (265)
Pumps and fans	199.4310	3.0700	612.2532 (267)
Energy for lighting	450.9135	3.0700	1384.3043 (268)
Energy saving/generation technologies			
PV Unit	-625.0681	3.0700	-1918.9592 (269)
Primary energy kWh/year			4917.1542 (272)
Primary energy kWh/m2/year			46.6700 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	96.4 (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	351.00 (P1)
Transmission heat loss coefficient	72.46 (37)
Summer heat loss coefficient	423.47 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
South East	0.000	1.000	None
North West	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs
South East	1.000	0.90	1.000
North West	1.000	0.90	1.000
North West	1.000	1.00	1.000

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	7.0100	127.3119	0.7200	0.7000	0.9000	364.3363
North West	1.6600	106.0502	0.7200	0.7000	0.9000	71.8679
North West	4.5100	106.0502	0.7200	0.7000	0.9000	195.2557
North West	0.8400	183.7429	0.6300	0.7000	1.0000	61.2592
total:						692.7191

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	747	693	607	
	541	520	530	

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

Total summer gains	1288	1213	1137	(P5)
Summer gain/loss ratio	3.04	2.86	2.69	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 96.4)	1.33	1.33	1.33	
Threshold temperature	19.77	21.49	21.31	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			