

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-148			Issued on Date	26/03/2024
Assessment Reference	As Built	Prop Type Ref	LVv2 Det As		
Property	7, Keepers Drive, Fair Oak, EASTLEIGH, SO50 7QR				
SAP Rating	88 B	DER	12.58	TER	17.11
Environmental	89 B	% DER<TER	26.48		
CO ₂ Emissions (t/year)	1.10	DFEE	48.65	TFEE	56.91
General Requirements Compliance	Pass	% DFEE<TFEE	14.51		
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk			Assessor ID	T510-0001
Client	Drew Smith				

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

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DWELLING AS BUILT

Detached House, total floor area 114 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) 17.11 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.58 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.39 (max. 2.00)	1.40 (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: 4.82 (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: 9.64 m², No overhang
Windows facing South West: 0.60 m², No overhang
Windows facing North West: 10.50 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.99 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	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =		0.0000 (8)	
Pressure test														Yes			
Measured/design AP50														4.8200			
Infiltration rate														0.2410 (18)			
Number of sides sheltered														0 (19)			
Shelter factor										(20) = 1 - [0.075 x (19)] =				1.0000 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.2410 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate																	
	0.3073	0.3013	0.2952	0.2651	0.2591	0.2290	0.2290	0.2229	0.2410	0.2591	0.2711	0.2832 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																0.5000 (23a)	
Effective ac	0.5573	0.5513	0.5452	0.5151	0.5091	0.5000	0.5000	0.5000	0.5000	0.5091	0.5211	0.5332 (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)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum(A, m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			18.0000	1021.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10164.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							89.5433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1282 (36)
Total fabric heat loss						(33) + (36) =	86.7328 (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	53.1305	52.5560	51.9816	49.1095	48.5351	47.6699	47.6699	47.6699	47.6699	48.5351	49.6839	50.8328 (38)
Heat transfer coeff	139.8632	139.2888	138.7144	135.8423	135.2678	134.4026	134.4026	134.4026	134.4026	135.2678	136.4167	137.5655 (39)
Average = Sum(39)m / 12 =												136.3198 (39)
HLP	1.2321	1.2270	1.2219	1.1966	1.1916	1.1840	1.1840	1.1840	1.1840	1.1916	1.2017	1.2118 (40)
HLP (average)												1.2008 (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	2.8344 (42)
Average daily hot water use (litres/day)	101.5166 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Energy conte	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1597.2519 (45)
	24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526	24.0563 (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												
	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (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												
	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) = Sum(64)m =				2107.6679 (64)
	89.7426	79.4820	84.3749	76.8865	76.2516	69.4345	67.9218	72.8254	72.1623	79.6657	82.6666	88.0052 (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	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	25.1198	22.3112	18.1447	13.7367	10.2683	8.6690	9.3671	12.1757	16.3422	20.7502	24.2186	25.8180 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	276.5194	279.3888	272.1580	256.7645	237.3329	219.0699	206.8692	203.9998	211.2306	226.6241	246.0557	264.3187 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719 (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)												
	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754 (71)
Water heating gains (Table 5)												
	120.6218	118.2768	113.4071	106.7868	102.4887	96.4368	91.2927	97.8836	100.2254	107.0775	114.8148	118.2866 (72)
Total internal gains												
	490.7768	488.4925	472.2256	445.8038	418.6057	392.6914	376.0448	382.5749	396.3140	422.9676	453.6048	476.9389 (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					9.6400	36.7938	0.7200	0.7000	0.7700	123.8842 (77)			
Southwest					0.6000	36.7938	0.7200	0.7000	0.7700	7.7106 (79)			
Northwest					5.2800	11.2829	0.7200	0.7000	0.7700	20.8075 (81)			
Northwest					5.2200	11.2829	0.7200	0.7000	0.7700	20.5711 (81)			
Solar gains	172.9734	308.3819	458.4489	629.2322	760.6455	779.7128	741.5023	639.7061	516.9999	350.6710	209.6852	146.4096 (83)	
Total gains	663.7501	796.8745	930.6745	1075.0360	1179.2512	1172.4042	1117.5471	1022.2810	913.3138	773.6387	663.2900	623.3485 (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	20.1883	20.2716	20.3555	20.7859	20.8741	21.0085	21.0085	21.0085	21.0085	20.8741	20.6983	20.5255
alpha	2.3459	2.3514	2.3570	2.3857	2.3916	2.4006	2.4006	2.4006	2.4006	2.3916	2.3799	2.3684
util living area	0.9620	0.9416	0.9055	0.8352	0.7276	0.5910	0.4681	0.5175	0.7113	0.8760	0.9450	0.9668 (86)
MIT	18.2336	18.5633	19.0883	19.7687	20.3384	20.7225	20.8868	20.8521	20.5393	19.7941	18.9082	18.1949 (87)
Th 2	19.8944	19.8985	19.9025	19.9227	19.9267	19.9329	19.9329	19.9329	19.9329	19.9267	19.9186	19.9106 (88)
util rest of house	0.9565	0.9332	0.8916	0.8103	0.6844	0.5216	0.3728	0.4219	0.6504	0.8517	0.9358	0.9620 (89)
MIT 2	16.2031	16.6805	17.4362	18.4083	19.1862	19.6772	19.8568	19.8270	19.4714	18.4666	17.1961	16.1552 (90)
Living area fraction									fLA = Living area / (4) =			0.1117 (91)
MIT	16.4299	16.8908	17.6208	18.5603	19.3149	19.7940	19.9719	19.9415	19.5907	18.6149	17.3873	16.3831 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.2799	16.7408	17.4708	18.4103	19.1649	19.6440	19.8219	19.7915	19.4407	18.4649	17.2373	16.2331 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9280	0.8976	0.8492	0.7662	0.6488	0.5007	0.3621	0.4079	0.6172	0.8072	0.9012	0.9359 (94)
Useful gains	615.9320	715.2912	790.3006	823.7286	765.0447	587.0514	404.6597	417.0023	563.6809	624.4942	597.7558	583.4040 (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												
	1675.5474	1649.2966	1521.8016	1291.8943	1009.7647	677.9248	433.0284	455.8307	717.8001	1063.8661	1382.9022	1655.3359 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

788.3539	627.6516	544.2367	337.0793	182.0716	0.0000	0.0000	0.0000	0.0000	326.8927	565.3054	797.5174 (98)
Space heating											4169.1087 (98)
Space heating per m2											(98) / (4) = 36.7258 (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	4601.6652 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	788.3539	627.6516	544.2367	337.0793	182.0716	0.0000	0.0000	0.0000	0.0000	326.8927	565.3054	797.5174	(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)	870.1478	692.7722	600.7028	372.0522	200.9621	0.0000	0.0000	0.0000	0.0000	360.8087	623.9574	880.2620	(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	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260	(64)
Efficiency of water heater (217)m	88.1273	87.9306	87.5335	86.6745	85.1230	79.9000	79.9000	79.9000	79.9000	86.5063	87.6515	79.9000	(216)
Fuel for water heating, kWh/month	237.1015	209.2454	220.2673	198.7349	197.8042	187.5348	179.3802	197.8379	197.8025	206.5107	216.3526	230.9903	(219)
Water heating fuel used												2479.5624	(219)
Annual totals kWh/year													
Space heating fuel - main system												4601.6652	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)

mechanical ventilation fans (SFP = 0.2302)	81.1539 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	156.1539 (231)
Electricity for lighting (calculated in Appendix L)	443.6236 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 0.99 * 1004 * 1.00) =	-795.1650	-795.1650 (233)
Total delivered energy for all uses		6885.8401 (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	4601.6652	0.2160	993.9597 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2479.5624	0.2160	535.5855 (264)
Space and water heating			1529.5452 (265)
Pumps and fans	156.1539	0.5190	81.0439 (267)
Energy for lighting	443.6236	0.5190	230.2407 (268)
Energy saving/generation technologies			
PV Unit	-795.1650	0.5190	-412.6906 (269)
Total CO2, kg/year			1428.1390 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5800 (273)

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

DER	12.5800	ZC1
Total Floor Area	113.5200	TFA
Assumed number of occupants	2.8344	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	14.4344	ZC2
CO2 emissions from cooking, equation (L16)	1.6475	ZC3
Total CO2 emissions	28.6619	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	28.6619	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (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							4 * 10 =	40.0000 (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) =						40.0000 / (5) =	0.1385 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3885	(18)				
Number of sides sheltered							0	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	1.0000 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3885 (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	0.4953	0.4856	0.4759	0.4273	0.4176	0.3690	0.3690	0.3593	0.3885	0.4176	0.4370	0.4564 (22b)
Effective ac	0.6226	0.6179	0.6132	0.5913	0.5872	0.5681	0.5681	0.5646	0.5754	0.5872	0.5955	0.6042 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			20.7400	1.3258	27.4962		(27)					
150mm EPS B&B			56.7600	0.1300	7.3788		(28a)					
140mm Timber Frame	153.8700	22.8600	131.0100	0.1800	23.5818		(29a)					
400mm Mineral Wool	56.7600		56.7600	0.1300	7.3788		(30)					
Total net area of external elements Aum(A, m2)			267.3900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.9556		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5035 (36)					
Total fabric heat loss						(33) + (36) =	79.4591 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 59.3633	Feb 58.9092	Mar 58.4641	Apr 56.3736	May 55.9825	Jun 54.1617	Jul 54.1617	Aug 53.8245	Sep 54.8630	Oct 55.9825	Nov 56.7737	Dec 57.6009 (38)
Heat transfer coeff	138.8224	138.3683	137.9232	135.8327	135.4416	133.6208	133.6208	133.2836	134.3222	135.4416	136.2328	137.0600 (39)
Average = Sum(39)m / 12 =												135.8308 (39)
HLP	Jan 1.2229	Feb 1.2189	Mar 1.2150	Apr 1.1966	May 1.1931	Jun 1.1771	Jul 1.1771	Aug 1.1741	Sep 1.1832	Oct 1.1931	Nov 1.2001	Dec 1.2074 (40)
HLP (average)												1.1965 (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												2.8344 (42)
Average daily hot water use (litres/day)												101.5166 (43)
Daily hot water use	Jan 111.6683	Feb 107.6076	Mar 103.5470	Apr 99.4863	May 95.4256	Jun 91.3650	Jul 91.3650	Aug 95.4256	Sep 99.4863	Oct 103.5470	Nov 107.6076	Dec 111.6683 (44)
Energy conte	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Energy content (annual)										Total = Sum(45)m =		1597.2519 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526		24.0563 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	213.9786	188.5315	197.8350	177.1176	173.4042	154.7055	148.3521	163.0998	162.9093	183.6720	194.5014	208.7533 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	213.9786	188.5315	197.8350	177.1176	173.4042	154.7055	148.3521	163.0998	162.9093	183.6720	194.5014	208.7533 (64)
Heat gains from water heating, kWh/month	93.7644	83.1146	88.3967	80.7786	80.2735	73.3266	71.9436	76.8473	76.0544	83.6875	86.5587	92.0270 (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	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1198	22.3112	18.1447	13.7367	10.2683	8.6690	9.3671	12.1757	16.3422	20.7502	24.2186	25.8180	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.5194	279.3888	272.1580	256.7645	237.3329	219.0699	206.8692	203.9998	211.2306	226.6241	246.0557	264.3187	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	(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)	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	(71)
Water heating gains (Table 5)	126.0275	123.6825	118.8128	112.1925	107.8944	101.8425	96.6984	103.2893	105.6311	112.4832	120.2205	123.6923	(72)
Total internal gains	496.1825	493.8982	477.6313	451.2095	424.0114	398.0971	381.4505	387.9806	401.7197	428.3733	459.0105	482.3446	(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				9.6400	36.7938	0.6300	0.7000	0.7700	108.3987 (77)			
Southwest				0.6000	36.7938	0.6300	0.7000	0.7700	6.7468 (79)			
Northwest				10.5000	11.2829	0.6300	0.7000	0.7700	36.2062 (81)			
Solar gains	151.3517	269.8342	401.1428	550.5782	665.5648	682.2487	648.8145	559.7428	452.3749	306.8371	183.4745	128.1084 (83)
Total gains	647.5342	763.7324	878.7740	1001.7876	1089.5763	1080.3458	1030.2650	947.7234	854.0946	735.2105	642.4851	610.4530 (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	56.7872	56.9736	57.1574	58.0371	58.2047	58.9978	58.9978	59.1470	58.6897	58.2047	57.8666	57.5174
alpha	4.7858	4.7982	4.8105	4.8691	4.8803	4.9332	4.9332	4.9431	4.9126	4.8803	4.8578	4.8345
util living area	0.9984	0.9961	0.9892	0.9629	0.8841	0.7221	0.5547	0.6182	0.8629	0.9795	0.9965	0.9988 (86)
MIT	19.6350	19.8014	20.0756	20.4430	20.7567	20.9382	20.9865	20.9776	20.8439	20.4349	19.9724	19.6139 (87)
Th 2	19.9017	19.9049	19.9080	19.9228	19.9255	19.9384	19.9384	19.9408	19.9334	19.9255	19.9199	19.9141 (88)
util rest of house	0.9978	0.9948	0.9852	0.9483	0.8390	0.6286	0.4290	0.4899	0.7932	0.9689	0.9951	0.9984 (89)
MIT 2	18.0844	18.3295	18.7302	19.2653	19.6852	19.8972	19.9334	19.9315	19.8056	19.2634	18.5905	18.0622 (90)
Living area fraction												
MIT	18.2576	18.4939	18.8805	19.3968	19.8049	20.0135	20.0511	20.0484	19.9216	19.3943	18.7448	18.2355 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2576	18.4939	18.8805	19.3968	19.8049	20.0135	20.0511	20.0484	19.9216	19.3943	18.7448	18.2355 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	645.2575	757.6954	860.9348	940.6633	907.6423	686.9436	456.2645	477.3539	676.6474	706.8359	637.7247	608.8294	(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	1937.6230	1880.9674	1707.5556	1425.8124	1097.7391	723.3516	461.1343	486.2681	781.9691	1191.1098	1586.4105	1923.7100	(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	961.5200	754.8388	629.8858	349.3074	141.4320	0.0000	0.0000	0.0000	0.0000	360.2998	683.0538	978.2711	(98)
Space heating												4858.6086	(98)
Space heating per m2												42.7996	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												5196.3728 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	961.5200	754.8388	629.8858	349.3074	141.4320	0.0000	0.0000	0.0000	0.0000	360.2998	683.0538	978.2711 (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)	1028.3636	807.3142	673.6747	373.5908	151.2642	0.0000	0.0000	0.0000	0.0000	385.3474	730.5388	1046.2793 (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	213.9786	188.5315	197.8350	177.1176	173.4042	154.7055	148.3521	163.0998	162.9093	183.6720	194.5014	208.7533 (64)
Efficiency of water heater (217)m	88.3437	88.1382	87.6897	86.5935	84.2761	79.8000	79.8000	79.8000	79.8000	86.5802	87.8881	79.8000 (216)
Fuel for water heating, kWh/month	242.2114	213.9045	225.6080	204.5393	205.7571	193.8665	185.9049	204.3857	204.1471	212.1409	221.3058	88.4151 (217)
Water heating fuel used												236.1059 (219)
Annual totals kWh/year												2549.8770 (219)
Space heating fuel - main system												5196.3728 (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)												443.6236 (232)
Total delivered energy for all uses												8264.8734 (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	5196.3728	0.2160	1122.4165 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2549.8770	0.2160	550.7734 (264)
Space and water heating			1673.1899 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.6236	0.5190	230.2407 (268)
Total CO2, kg/m2/year			1942.3556 (272)
Emissions per m2 for space and water heating			14.7392 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0282 (272b)
Emissions per m2 for pumps and fans			0.3429 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7392 * 1.00) + 2.0282 + 0.3429, rounded to 2 d.p.			17.1100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (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) = 0.1385 (8)
Pressure test					Yes
Measured/design AP50					4.8200
Infiltration rate					0.3795 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3795 (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	0.4838	0.4743	0.4648	0.4174	0.4079	0.3605	0.3605	0.3510	0.3795	0.4079	0.4269	0.4459 (22b)
Effective ac	0.6170	0.6125	0.6080	0.5871	0.5832	0.5650	0.5650	0.5616	0.5720	0.5832	0.5911	0.5994 (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)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum (m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			9.0000	510.8400 (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) =	9654.1200 (34)
	85.0433 (35)
	15.1282 (36)
(33) + (36) =	86.7328 (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	58.8277	58.3944	57.9697	55.9750	55.6017	53.8644	53.8644	53.5426	54.5336	55.6017	56.3568	57.1461 (38)
Heat transfer coeff	145.5604	145.1272	144.7025	142.7077	142.3345	140.5971	140.5971	140.2754	141.2663	142.3345	143.0895	143.8788 (39)
Average = Sum(39)m / 12 =												142.7059 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2822	1.2784	1.2747	1.2571	1.2538	1.2385	1.2385	1.2357	1.2444	1.2538	1.2605	1.2674 (40)
HLP (average)												1.2571 (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												2.8344 (42)
Average daily hot water use (litres/day)												101.5166 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy conte	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Energy content (annual)										Total = Sum(45)m =		1597.2519 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.1902	30.7776	31.7597	27.6889	26.5681	22.9263	21.2446	24.3784	24.6696	28.7500	31.3829	34.0798 (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	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1198	22.3112	18.1447	13.7367	10.2683	8.6690	9.3671	12.1757	16.3422	20.7502	24.2186	25.8180	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.5194	279.3888	272.1580	256.7645	237.3329	219.0699	206.8692	203.9998	211.2306	226.6241	246.0557	264.3187	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	(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)	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	(71)
Water heating gains (Table 5)	47.2986	45.7999	42.6877	38.4567	35.7098	31.8420	28.5545	32.7667	34.2633	38.6425	43.5874	45.8062	(72)
Total internal gains	414.4536	413.0157	398.5062	374.4737	348.8268	325.0967	310.3066	314.4580	327.3519	351.5326	379.3774	401.4586	(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					9.6400	36.7938		0.7200	0.7000	0.7700	123.8842 (77)	
Southwest					0.6000	36.7938		0.7200	0.7000	0.7700	7.7106 (79)	
Northwest					5.2800	11.2829		0.7200	0.7000	0.7700	20.8075 (81)	
Northwest					5.2200	11.2829		0.7200	0.7000	0.7700	20.5711 (81)	

Solar gains	172.9734	308.3819	458.4489	629.2322	760.6455	779.7128	741.5023	639.7061	516.9999	350.6710	209.6852	146.4096 (83)
Total gains	587.4270	721.3976	856.9551	1003.7059	1109.4724	1104.8095	1051.8089	954.1641	844.3518	702.2037	589.0626	547.8681 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.4233	18.4783	18.5325	18.7916	18.8408	19.0736	19.0736	19.1174	18.9833	18.8408	18.7414	18.6386	
alpha	2.2282	2.2319	2.2355	2.2528	2.2561	2.2716	2.2716	2.2745	2.2656	2.2561	2.2494	2.2426	
util living area	0.9676	0.9487	0.9154	0.8512	0.7514	0.6206	0.5001	0.5517	0.7419	0.8928	0.9535	0.9721	(86)
MIT	17.9335	18.2759	18.8310	19.5503	20.1848	20.6417	20.8450	20.8010	20.4185	19.5804	18.6314	17.8803	(87)
Th 2	19.8548	19.8578	19.8607	19.8746	19.8772	19.8893	19.8893	19.8916	19.8846	19.8772	19.8719	19.8664	(88)
util rest of house	0.9629	0.9412	0.9027	0.8276	0.7093	0.5498	0.3988	0.4515	0.6823	0.8708	0.9455	0.9679	(89)
MIT 2	17.0582	17.3982	17.9459	18.6526	19.2501	19.6614	19.8174	19.7928	19.4823	18.6977	17.7633	17.0130	(90)
Living area fraction	17.1559	17.4962	18.0448	18.7528	19.3545	19.7709	19.9322	19.9055	19.5868	18.7963	17.8603	17.1098	(92)
Temperature adjustment	17.1559	17.4962	18.0448	18.7528	19.3545	19.7709	19.9322	19.9055	19.5868	18.7963	17.8603	17.1098	(93)
adjusted MIT	17.1559	17.4962	18.0448	18.7528	19.3545	19.7709	19.9322	19.9055	19.5868	18.7963	17.8603	17.1098	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9468	0.9200	0.8762	0.7989	0.6866	0.5414	0.4031	0.4529	0.6636	0.8434	0.9256	0.9535	(94)
Ext temp.	556.1988	663.7214	750.8694	801.8884	761.7219	598.1520	423.9496	432.1702	560.3087	592.2089	545.2409	522.3908	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1871.3149	1828.0514	1670.5609	1406.0756	1089.4975	727.0127	468.4916	491.7295	775.1053	1166.6202	1539.6864	1857.4520	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	978.4464	782.4297	684.2505	435.0148	243.8651	0.0000	0.0000	0.0000	0.0000	427.3621	716.0008	993.2855	(98)
Space heating per m2												5260.6549	(98)
												46.3412	(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	1321.6130	1040.4187	1066.0930	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7149	0.7763	0.7418	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	944.8147	807.6564	790.8043	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1403.3655	1338.9517	1226.9201	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	330.1566	395.2837	324.4702	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1049.9104 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	82.5391	98.8209	81.1175	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												262.4776 (107)
Space cooling per m2												2.3122 (108)
Energy for space heating												46.3412 (99)
Energy for space cooling												2.3122 (108)
Total												48.6534 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (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) =					40.0000	/ (5) =	0.1385 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3885 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3885	(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	0.4953	0.4856	0.4759	0.4273	0.4176	0.3690	0.3690	0.3593	0.3885	0.4176	0.4370	0.4564	(22b)				
Effective ac	0.6226	0.6179	0.6132	0.5913	0.5872	0.5681	0.5681	0.5646	0.5754	0.5872	0.5955	0.6042	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			20.7400	1.3258	27.4962		(27)					
150mm EPS B&B			56.7600	0.1300	7.3788		(28a)					
140mm Timber Frame	153.8700	22.8600	131.0100	0.1800	23.5818		(29a)					
400mm Mineral Wool	56.7600		56.7600	0.1300	7.3788		(30)					
Total net area of external elements Aum(A, m2)			267.3900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		67.9556		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5035 (36)					
Total fabric heat loss						(33) + (36) =	79.4591 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 59.3633	Feb 58.9092	Mar 58.4641	Apr 56.3736	May 55.9825	Jun 54.1617	Jul 54.1617	Aug 53.8245	Sep 54.8630	Oct 55.9825	Nov 56.7737	Dec 57.6009 (38)
Heat transfer coeff	138.8224	138.3683	137.9232	135.8327	135.4416	133.6208	133.6208	133.2836	134.3222	135.4416	136.2328	137.0600 (39)
Average = Sum(39)m / 12 =												135.8308 (39)
HLP	Jan 1.2229	Feb 1.2189	Mar 1.2150	Apr 1.1966	May 1.1931	Jun 1.1771	Jul 1.1771	Aug 1.1741	Sep 1.1832	Oct 1.1931	Nov 1.2001	Dec 1.2074 (40)
HLP (average)												1.1965 (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												2.8344 (42)
Average daily hot water use (litres/day)												101.5166 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy content (annual)	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1597.2519 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (57)
Heat gains from water heating, kWh/month	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)
	35.1902	30.7776	31.7597	27.6889	26.5681	22.9263	21.2446	24.3784	24.6696	28.7500	31.3829	34.0798 (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	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1198	22.3112	18.1447	13.7367	10.2683	8.6690	9.3671	12.1757	16.3422	20.7502	24.2186	25.8180	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.5194	279.3888	272.1580	256.7645	237.3329	219.0699	206.8692	203.9998	211.2306	226.6241	246.0557	264.3187	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	(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)	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	(71)
Water heating gains (Table 5)	47.2986	45.7999	42.6877	38.4567	35.7098	31.8420	28.5545	32.7667	34.2633	38.6425	43.5874	45.8062	(72)
Total internal gains	414.4536	413.0157	398.5062	374.4737	348.8268	325.0967	310.3066	314.4580	327.3519	351.5326	379.3774	401.4586	(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					9.6400	36.7938	0.6300	0.7000	0.7700	108.3987 (77)		
Southwest					0.6000	36.7938	0.6300	0.7000	0.7700	6.7468 (79)		
Northwest					10.5000	11.2829	0.6300	0.7000	0.7700	36.2062 (81)		
Solar gains	151.3517	269.8342	401.1428	550.5782	665.5648	682.2487	648.8145	559.7428	452.3749	306.8371	183.4745	128.1084 (83)
Total gains	565.8053	682.8499	799.6490	925.0518	1014.3917	1007.3454	959.1211	874.2008	779.7268	658.3698	562.8520	529.5669 (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	56.7872	56.9736	57.1574	58.0371	58.2047	58.9978	58.9978	59.1470	58.6897	58.2047	57.8666	57.5174	
alpha	4.7858	4.7982	4.8105	4.8691	4.8803	4.9332	4.9332	4.9431	4.9126	4.8803	4.8578	4.8345	
util living area	0.9991	0.9976	0.9927	0.9724	0.9060	0.7570	0.5905	0.6601	0.8939	0.9868	0.9981	0.9994	(86)
MIT	19.5687	19.7364	20.0139	20.3896	20.7205	20.9237	20.9823	20.9703	20.8110	20.3771	19.9081	19.5480	(87)
Th 2	19.9017	19.9049	19.9080	19.9228	19.9255	19.9384	19.9384	19.9408	19.9334	19.9255	19.9199	19.9141	(88)
util rest of house	0.9988	0.9968	0.9899	0.9611	0.8664	0.6649	0.4593	0.5277	0.8329	0.9796	0.9972	0.9991	(89)
MIT 2	18.5948	18.7647	19.0432	19.4238	19.7324	19.9025	19.9338	19.9321	19.8231	19.4181	18.9483	18.5839	(90)
Living area fraction									fLA = Living area / (4) =			0.1117	(91)
MIT	18.7036	18.8732	19.1516	19.5317	19.8428	20.0166	20.0510	20.0480	19.9335	19.5253	19.0555	18.6916	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7036	18.8732	19.1516	19.5317	19.8428	20.0166	20.0510	20.0480	19.9335	19.5253	19.0555	18.6916	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9983	0.9956	0.9872	0.9557	0.8627	0.6724	0.4740	0.5422	0.8329	0.9759	0.9962	0.9988	(94)
Ext temp.	564.8401	679.8486	789.3883	884.0378	875.0948	677.3591	454.5756	473.9723	649.4381	642.4743	560.7362	528.9154	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1999.5367	1933.4488	1744.9527	1444.1299	1102.8701	723.7703	461.1188	486.2224	783.5653	1208.8506	1628.7291	1986.2202	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(98)
Space heating per m2	1067.4142	842.4193	710.9399	403.2663	169.4649	0.0000	0.0000	0.0000	0.0000	421.3840	768.9549	1084.2347	(99)
										(98) / (4) =		48.1684	(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	1256.0357	988.7941	1012.9557	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8422	0.9081	0.8748	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1057.8076	897.9613	886.1583	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1289.4464	1230.6153	1133.4566	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	166.7799	247.4946	183.9899	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												598.2644	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	41.6950	61.8736	45.9975	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												149.5661 (107)
Space cooling per m2												1.3175 (108)
Energy for space heating												48.1684 (99)
Energy for space cooling												1.3175 (108)
Total												49.4859 (109)
Target Fabric Energy Efficiency (TFEE)												56.9 (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	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															4.8200		
Infiltration rate															0.2410 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2410 (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	0.2651	0.2470	0.2470	0.2350	0.2350	0.2229	0.2229	0.2109	0.2109	0.2290	0.2229	0.2350 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5151	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)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum(A, m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			18.0000	1021.6800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10164.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							89.5433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1282 (36)
Total fabric heat loss							(33) + (36) = 86.7328 (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	49.1095	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699 (38)
Heat transfer coeff	135.8423	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026 (39)
Average = Sum(39)m / 12 =												134.5226 (39)
HLP	1.1966	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840 (40)
HLP (average)												1.1850 (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 2.8344 (42)
Average daily hot water use (litres/day) 101.5166 (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 HEAT DEMAND 09 Jan 2014

Energy conte	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1597.2519 (45)
	24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526	24.0563 (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												
Solar input	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (62)
	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	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (64)
												2107.6679 (64)
RHI water heating demand												2108 (64)
Heat gains from water heating, kWh/month	89.7426	79.4820	84.3749	76.8865	76.2516	69.4345	67.9218	72.8254	72.1623	79.6657	82.6666	88.0052 (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	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7995	55.7780	45.3617	34.3417	25.6708	21.6724	23.4178	30.4393	40.8556	51.8756	60.5465	64.5449	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	412.7156	416.9983	406.2060	383.2306	354.2282	326.9701	308.7600	304.4773	315.2695	338.2450	367.2473	394.5055	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	(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)	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	(71)
Water heating gains (Table 5)	120.6218	118.2768	113.4071	106.7868	102.4887	96.4368	91.2927	97.8836	100.2254	107.0775	114.8148	118.2866	(72)
Total internal gains	710.6652	705.5814	679.5032	638.8875	596.9161	559.6076	537.9989	547.3286	570.8789	611.7264	657.1369	691.8653	(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					9.6400	45.1778		0.7200	0.7000	0.7700	152.1129 (77)	
Southwest					0.6000	45.1778		0.7200	0.7000	0.7700	9.4676 (79)	
Northwest					5.2800	14.6176		0.7200	0.7000	0.7700	26.9572 (81)	
Northwest					5.2200	14.6176		0.7200	0.7000	0.7700	26.6509 (81)	

Solar gains	215.1887	327.6693	494.1777	687.0476	788.2963	886.8526	813.3659	730.4556	585.9176	397.7960	260.2492	172.2770 (83)
Total gains	925.8539	1033.2507	1173.6809	1325.9351	1385.2124	1446.4602	1351.3648	1277.7842	1156.7965	1009.5224	917.3862	864.1423 (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	20.7859	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	
alpha	2.3857	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	
util living area	0.9169	0.8920	0.8375	0.7433	0.6077	0.4288	0.3127	0.3287	0.5519	0.7667	0.8799	0.9255	(86)
MIT	18.9029	19.1626	19.6432	20.1825	20.6351	20.8919	20.9651	20.9611	20.7883	20.2774	19.5300	18.8712	(87)
Th 2	19.9227	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	(88)
util rest of house	0.9054	0.8775	0.8155	0.7083	0.5523	0.3517	0.2174	0.2293	0.4743	0.7250	0.8607	0.9150	(89)
MIT 2	17.1793	17.5538	18.2313	18.9714	19.5605	19.8520	19.9175	19.9155	19.7531	19.1207	18.0856	17.1412	(90)
Living area fraction	17.3718	17.7335	18.3890	19.1066	19.6805	19.9681	20.0345	20.0323	19.8687	19.2499	18.2469	17.3345	(91)
MIT	17.3718	17.7335	18.3890	19.1066	19.6805	19.9681	20.0345	20.0323	19.8687	19.2499	18.2469	17.3345	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.2218	17.5835	18.2390	18.9566	19.5305	19.8181	19.8845	19.8823	19.7187	19.0999	18.0969	17.1845	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	801.1513	862.8074	905.9864	889.8586	733.1740	496.0073	287.6820	286.6581	528.8305	692.3355	749.6208	757.5267	(94)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1605.9018	1570.2915	1429.9119	1203.7957	864.2823	526.6050	293.6001	293.3063	593.8871	954.2403	1303.2879	1570.4240	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating kWh	598.7343	475.4293	389.8006	226.0347	97.5446	0.0000	0.0000	0.0000	0.0000	194.8572	398.6403	604.7956 (98)
Space heating												2985.8366 (98)
RHI space heating demand												2986 (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	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															4.8200		
Infiltration rate															0.2410 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2410 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate																	
	0.3073	0.3013	0.2952	0.2651	0.2591	0.2290	0.2290	0.2229	0.2410	0.2591	0.2711	0.2832 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5573	0.5513	0.5452	0.5151	0.5091	0.5000	0.5000	0.5000	0.5000	0.5091	0.5211	0.5332 (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)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum(A, m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			18.0000	1021.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10164.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							89.5433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1282 (36)
Total fabric heat loss						(33) + (36) =	86.7328 (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	53.1305	52.5560	51.9816	49.1095	48.5351	47.6699	47.6699	47.6699	47.6699	48.5351	49.6839	50.8328 (38)
Heat transfer coeff	139.8632	139.2888	138.7144	135.8423	135.2678	134.4026	134.4026	134.4026	134.4026	135.2678	136.4167	137.5655 (39)
Average = Sum(39)m / 12 =												136.3198 (39)
HLP	1.2321	1.2270	1.2219	1.1966	1.1916	1.1840	1.1840	1.1840	1.1840	1.1916	1.2017	1.2118 (40)
HLP (average)												1.2008 (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	2.8344 (42)
Average daily hot water use (litres/day)	101.5166 (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 ENERGY RATINGS 09 Jan 2014

Energy conte	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1597.2519 (45)
	24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526	24.0563 (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												
Solar input	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (62)
	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	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (64)
Heat gains from water heating, kWh/month												
	89.7426	79.4820	84.3749	76.8865	76.2516	69.4345	67.9218	72.8254	72.1623	79.6657	82.6666	88.0052 (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	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	62.7995	55.7780	45.3617	34.3417	25.6708	21.6724	23.4178	30.4393	40.8556	51.8756	60.5465	64.5449 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	412.7156	416.9983	406.2060	383.2306	354.2282	326.9701	308.7600	304.4773	315.2695	338.2450	367.2473	394.5055 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407 (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)												
	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754 (71)
Water heating gains (Table 5)												
	120.6218	118.2768	113.4071	106.7868	102.4887	96.4368	91.2927	97.8836	100.2254	107.0775	114.8148	118.2866 (72)
Total internal gains												
	710.6652	705.5814	679.5032	638.8875	596.9161	559.6076	537.9989	547.3286	570.8789	611.7264	657.1369	691.8653 (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				9.6400	36.7938	0.7200		0.7000		0.7700		123.8842 (77)
Southwest				0.6000	36.7938	0.7200		0.7000		0.7700		7.7106 (79)
Northwest				5.2800	11.2829	0.7200		0.7000		0.7700		20.8075 (81)
Northwest				5.2200	11.2829	0.7200		0.7000		0.7700		20.5711 (81)
Solar gains	172.9734	308.3819	458.4489	629.2322	760.6455	779.7128	741.5023	639.7061	516.9999	350.6710	209.6852	146.4096 (83)
Total gains	883.6386	1013.9633	1137.9521	1268.1197	1357.5617	1339.3204	1279.5012	1187.0347	1087.8788	962.3975	866.8221	838.2748 (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	20.1883	20.2716	20.3555	20.7859	20.8741	21.0085	21.0085	21.0085	21.0085	20.8741	20.6983	20.5255
alpha	2.3459	2.3514	2.3570	2.3857	2.3916	2.4006	2.4006	2.4006	2.4006	2.3916	2.3799	2.3684
util living area	0.9339	0.9089	0.8669	0.7895	0.6779	0.5402	0.4202	0.4623	0.6478	0.8240	0.9093	0.9403 (86)
MIT	18.5379	18.8429	19.3234	19.9392	20.4413	20.7734	20.9108	20.8848	20.6307	19.9849	19.1741	18.4996 (87)
Th 2	19.8944	19.8985	19.9025	19.9227	19.9267	19.9329	19.9329	19.9329	19.9329	19.9267	19.9186	19.9106 (88)
util rest of house	0.9249	0.8968	0.8490	0.7606	0.6324	0.4722	0.3312	0.3722	0.5841	0.7934	0.8953	0.9322 (89)
MIT 2	16.6386	17.0768	17.7627	18.6344	19.3108	19.7280	19.8743	19.8526	19.5722	18.7202	17.5711	16.5925 (90)
Living area fraction									fLA = Living area / (4) =			0.1117 (91)
MIT	16.8507	17.2741	17.9371	18.7802	19.4371	19.8447	19.9901	19.9679	19.6904	18.8614	17.7502	16.8055 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.7007	17.1241	17.7871	18.6302	19.2871	19.6947	19.8401	19.8179	19.5404	18.7114	17.6002	16.6555 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8874	0.8549	0.8041	0.7191	0.6018	0.4557	0.3230	0.3617	0.5576	0.7498	0.8537	0.8968 (94)
Useful gains	784.1149	866.8405	915.0450	911.8994	816.9561	610.2760	413.2962	429.3501	606.5524	721.6279	740.0387	751.7344 (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	1734.4065	1702.6754	1565.6768	1321.7664	1026.2840	684.7460	435.4722	459.3721	731.2048	1097.2155	1432.4011	1713.4514 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

707.0169	561.6810	484.0701	295.1042	155.7399	0.0000	0.0000	0.0000	0.0000	279.4372	498.5009	715.5174 (98)
Space heating											3697.0677 (98)
Space heating per m2											(98) / (4) = 32.5675 (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		4080.6487 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	707.0169	561.6810	484.0701	295.1042	155.7399	0.0000	0.0000	0.0000	0.0000	279.4372	498.5009	715.5174 (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)	780.3719	619.9570	534.2937	325.7221	171.8984	0.0000	0.0000	0.0000	0.0000	308.4296	550.2218	789.7543 (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	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (64)
Efficiency of water heater	87.9143	87.7020	87.2709	86.3385	84.7070	79.9000	79.9000	79.9000	79.9000	86.1032	87.3754	79.9000 (216)
Fuel for water heating, kWh/month	237.6761	209.7908	220.9300	199.5083	198.7756	187.5348	179.3802	197.8379	197.8025	207.4774	217.0362	231.5369 (219)
Water heating fuel used												2485.2867 (219)
Annual totals kWh/year												
Space heating fuel - main system												4080.6487 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)

mechanical ventilation fans (SFP = 0.2302)	81.1539 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	156.1539 (231)
Electricity for lighting (calculated in Appendix L)	443.6236 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 0.99 * 1004 * 1.00) =

	-795.1650	-795.1650 (233)
Total delivered energy for all uses		6370.5479 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4080.6487	3.4800	142.0066 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2485.2867	3.4800	86.4880 (247)
Mechanical ventilation fans	81.1539	13.1900	10.7042 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	443.6236	13.1900	58.5140 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-795.1650	13.1900	-104.8823 (252)
Total energy cost			322.7229 (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] =	0.8551 (257)
SAP value		88.0720
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4080.6487	0.2160	881.4201 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2485.2867	0.2160	536.8219 (264)
Space and water heating			1418.2421 (265)
Pumps and fans	156.1539	0.5190	81.0439 (267)
Energy for lighting	443.6236	0.5190	230.2407 (268)
Energy saving/generation technologies			
PV Unit	-795.1650	0.5190	-412.6906 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Total kg/year	1316.8359 (272)
CO2 emissions per m2	11.6000 (273)
EI value	88.8685
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	$3.48 / 0.8458 = 4.114$, stars = 4
Water heating environmental impact	$0.216 / 0.8458 = 0.2554$, 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	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															4.8200		
Infiltration rate															0.2410	(18)	
Number of sides sheltered															0	(19)	
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2410	(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	0.2651	0.2470	0.2470	0.2350	0.2350	0.2229	0.2229	0.2109	0.2109	0.2290	0.2229	0.2350	(22b)				
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000	(23a)	
Effective ac	0.5151	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)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum(A, m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			18.0000	1021.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10164.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							89.5433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1282 (36)
Total fabric heat loss						(33) + (36) =	86.7328 (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	49.1095	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699 (38)
Heat transfer coeff	135.8423	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026 (39)
Average = Sum(39)m / 12 =												134.5226 (39)
HLP	1.1966	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840 (40)
HLP (average)												1.1850 (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												2.8344 (42)
Average daily hot water use (litres/day)												101.5166 (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 EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Energy conte	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1597.2519 (45)
	24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526	24.0563 (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												
Solar input	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (62)
	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	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (64)
Heat gains from water heating, kWh/month												
	89.7426	79.4820	84.3749	76.8865	76.2516	69.4345	67.9218	72.8254	72.1623	79.6657	82.6666	88.0052 (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	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	62.7995	55.7780	45.3617	34.3417	25.6708	21.6724	23.4178	30.4393	40.8556	51.8756	60.5465	64.5449 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	412.7156	416.9983	406.2060	383.2306	354.2282	326.9701	308.7600	304.4773	315.2695	338.2450	367.2473	394.5055 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407 (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)												
	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754 (71)
Water heating gains (Table 5)												
	120.6218	118.2768	113.4071	106.7868	102.4887	96.4368	91.2927	97.8836	100.2254	107.0775	114.8148	118.2866 (72)
Total internal gains												
	710.6652	705.5814	679.5032	638.8875	596.9161	559.6076	537.9989	547.3286	570.8789	611.7264	657.1369	691.8653 (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				9.6400	45.1778	0.7200	0.7000		0.7700		152.1129 (77)	
Southwest				0.6000	45.1778	0.7200	0.7000		0.7700		9.4676 (79)	
Northwest				5.2800	14.6176	0.7200	0.7000		0.7700		26.9572 (81)	
Northwest				5.2200	14.6176	0.7200	0.7000		0.7700		26.6509 (81)	
Solar gains	215.1887	327.6693	494.1777	687.0476	788.2963	886.8526	813.3659	730.4556	585.9176	397.7960	260.2492	172.2770 (83)
Total gains	925.8539	1033.2507	1173.6809	1325.9351	1385.2124	1446.4602	1351.3648	1277.7842	1156.7965	1009.5224	917.3862	864.1423 (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	20.7859	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085
alpha	2.3857	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006
util living area	0.9169	0.8920	0.8375	0.7433	0.6077	0.4288	0.3127	0.3287	0.5519	0.7667	0.8799	0.9255 (86)
MIT	18.9029	19.1626	19.6432	20.1825	20.6351	20.8919	20.9651	20.9611	20.7883	20.2774	19.5300	18.8712 (87)
Th 2	19.9227	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329 (88)
util rest of house	0.9054	0.8775	0.8155	0.7083	0.5523	0.3517	0.2174	0.2293	0.4743	0.7250	0.8607	0.9150 (89)
MIT 2	17.1793	17.5538	18.2313	18.9714	19.5605	19.8520	19.9175	19.9155	19.7531	19.1207	18.0856	17.1412 (90)
Living area fraction									fLA = Living area / (4) =			0.1117 (91)
MIT	17.3718	17.7335	18.3890	19.1066	19.6805	19.9681	20.0345	20.0323	19.8687	19.2499	18.2469	17.3345 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2218	17.5835	18.2390	18.9566	19.5305	19.8181	19.8845	19.8823	19.7187	19.0999	18.0969	17.1845 (93)

8. Space heating requirement

Utilisation	0.8653	0.8350	0.7719	0.6711	0.5293	0.3429	0.2129	0.2243	0.4572	0.6858	0.8171	0.8766 (94)
Useful gains	801.1513	862.8074	905.9864	889.8586	733.1740	496.0073	287.6820	286.6581	528.8305	692.3355	749.6208	757.5267 (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												
	1605.9018	1570.2915	1429.9119	1203.7957	864.2823	526.6050	293.6001	293.3063	593.8871	954.2403	1303.2879	1570.4240 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space heating	598.7343	475.4293	389.8006	226.0347	97.5446	0.0000	0.0000	0.0000	0.0000	194.8572	398.6403	604.7956 (98)
Space heating per m2												2985.8366 (98)
										(98) / (4) =		26.3023 (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												3295.6254 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	598.7343	475.4293	389.8006	226.0347	97.5446	0.0000	0.0000	0.0000	0.0000	194.8572	398.6403	604.7956 (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)	660.8547	524.7564	430.2434	249.4864	107.6651	0.0000	0.0000	0.0000	0.0000	215.0741	440.0004	667.5448 (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	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (64)
Efficiency of water heater	87.5663	87.3366	86.7551	85.6400	83.5181	79.9000	79.9000	79.9000	79.9000	85.1462	86.8507	79.9000 (216)
Fuel for water heating, kWh/month	238.6207	210.6685	222.2436	201.1356	201.6051	187.5348	179.3802	197.8379	197.8025	209.8094	218.3475	232.4508 (219)
Water heating fuel used												2497.4365 (219)
Annual totals kWh/year												
Space heating fuel - main system												3295.6254 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												81.1539 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												156.1539 (231)
Electricity for lighting (calculated in Appendix L)												443.6236 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1115 * 1.00) =										-882.9989		-882.9989 (233)
Total delivered energy for all uses												5509.8405 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3295.6254	7.6100	250.7971 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2497.4365	7.6100	190.0549 (247)
Mechanical ventilation fans	81.1539	31.0800	25.2226 (249)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	443.6236	31.0800	137.8782 (250)
Additional standing charges			105.0000 (251)
Energy saving/generation technologies			
PV Unit	-882.9989	31.0800	-274.4361 (252)
Total energy cost			457.8268 (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	3295.6254	0.2160	711.8551 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2497.4365	0.2160	539.4463 (264)
Space and water heating			1251.3014 (265)
Pumps and fans	156.1539	0.5190	81.0439 (267)
Energy for lighting	443.6236	0.5190	230.2407 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	0.5190	-458.2764 (269)
Total kg/year			1104.3095 (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	3295.6254	1.2200	4020.6629 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Water heating (other fuel)	2497.4365	1.2200	3046.8726 (264)
Space and water heating			7067.5355 (265)
Pumps and fans	156.1539	3.0700	479.3923 (267)
Energy for lighting	443.6236	3.0700	1361.9245 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	3.0700	-2710.8066 (269)
Primary energy kWh/year			6198.0457 (272)
Primary energy kWh/m2/year			54.5987 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
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	+ 1.4	-£ 86	-263 kg (23.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£86	2.31 kg/m²	B 89 B 91
Total Savings	£86	2.31 kg/m²	

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	£186	£202	-£16
Mains gas	£546	£444	£102
Space heating	£404	£406	-£1
Water heating	£190	£102	£88
Lighting	£138	£138	£0
Generated (PV)	-£274	-£274	£0
Total cost of fuels	£458	£372	£86
Total cost of uses	£458	£372	£87
Delivered energy	49 kWh/m²	37 kWh/m²	11 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.8 tonnes	0.3 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	42 kWh/m²	13 kWh/m²

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	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (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					4.8200
Infiltration rate					0.2410 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2410 (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	0.3073	0.3013	0.2952	0.2651	0.2591	0.2290	0.2290	0.2229	0.2410	0.2591	0.2711	0.2832 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5573	0.5513	0.5452	0.5151	0.5091	0.5000	0.5000	0.5000	0.5000	0.5091	0.5211	0.5332 (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)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum(A, m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			18.0000	1021.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10164.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							89.5433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1282 (36)
Total fabric heat loss						(33) + (36) =	86.7328 (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	53.1305	52.5560	51.9816	49.1095	48.5351	47.6699	47.6699	47.6699	47.6699	48.5351	49.6839	50.8328 (38)
Heat transfer coeff	139.8632	139.2888	138.7144	135.8423	135.2678	134.4026	134.4026	134.4026	134.4026	135.2678	136.4167	137.5655 (39)
Average = Sum(39)m / 12 =												136.3198 (39)
HLP	1.2321	1.2270	1.2219	1.1966	1.1916	1.1840	1.1840	1.1840	1.1840	1.1916	1.2017	1.2118 (40)
HLP (average)												1.2008 (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												2.8344 (42)
Average daily hot water use (litres/day)												101.5166 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526	24.0563 (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	201.9576	177.6739	184.4183	158.7309	148.5889	130.4656	123.3042	138.9824	145.8733	170.2553	182.8682	196.7323 (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												1.1355 (H8)
Utilisation factor												0.5855 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												101.5166 (H14)
Volume ratio Veff/V												1.0786 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-933.7062 (H17)
Solar input	-27.0756	-45.1814	-76.9491	-103.1270	-127.4047	-125.2591	-123.6038	-107.9933	-84.5804	-57.7584	-32.1156	-22.6577 (63)
Solar input (sum of months) = Sum(63)m =												-933.7062 (63)
Output from w/h	174.8820	132.4925	107.4692	55.6039	21.1842	5.2064	0.0000	30.9891	61.2929	112.4969	150.7527	174.0747 (64)
Total per year (kWh/year) = Sum(64)m =												1026.4443 (64)
Heat gains from water heating, kWh/month	84.1477	74.4285	77.6634	66.0692	60.4212	53.9347	51.9053	57.5533	62.4255	72.9542	77.2522	82.4103 (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	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7995	55.7780	45.3617	34.3417	25.6708	21.6724	23.4178	30.4393	40.8556	51.8756	60.5465	64.5449	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	412.7156	416.9983	406.2060	383.2306	354.2282	326.9701	308.7600	304.4773	315.2695	338.2450	367.2473	394.5055	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	(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)	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	(71)
Water heating gains (Table 5)	113.1017	110.7567	104.3862	91.7628	81.2113	74.9092	69.7652	77.3566	86.7021	98.0567	107.2947	110.7665	(72)
Total internal gains	703.1452	698.0613	670.4823	623.8634	575.6388	538.0801	516.4714	526.8016	557.3556	602.7056	649.6169	684.3452	(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				9.6400	36.7938		0.7200		0.7000		0.7700		123.8842 (77)
Southwest				0.6000	36.7938		0.7200		0.7000		0.7700		7.7106 (79)
Northwest				5.2800	11.2829		0.7200		0.7000		0.7700		20.8075 (81)
Northwest				5.2200	11.2829		0.7200		0.7000		0.7700		20.5711 (81)
Solar gains	172.9734	308.3819	458.4489	629.2322	760.6455	779.7128	741.5023	639.7061	516.9999	350.6710	209.6852		146.4096 (83)
Total gains	876.1185	1006.4432	1128.9312	1253.0956	1336.2843	1317.7929	1257.9737	1166.5077	1074.3555	953.3766	859.3021		830.7548 (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	20.1883	20.2716	20.3555	20.7859	20.8741	21.0085	21.0085	21.0085	21.0085	20.8741	20.6983	20.5255
alpha	2.3459	2.3514	2.3570	2.3857	2.3916	2.4006	2.4006	2.4006	2.4006	2.3916	2.3799	2.3684
util living area	0.9349	0.9101	0.8686	0.7930	0.6836	0.5464	0.4260	0.4687	0.6525	0.8265	0.9107	0.9414 (86)
MIT	18.5279	18.8337	19.3138	19.9269	20.4301	20.7676	20.9080	20.8813	20.6245	19.9765	19.1648	18.4894 (87)
Th 2	19.8944	19.8985	19.9025	19.9227	19.9267	19.9329	19.9329	19.9329	19.9329	19.9267	19.9186	19.9106 (88)
util rest of house	0.9261	0.8981	0.8509	0.7644	0.6383	0.4781	0.3363	0.3778	0.5889	0.7961	0.8969	0.9334 (89)
MIT 2	16.6244	17.0639	17.7495	18.6183	19.2974	19.7222	19.8723	19.8499	19.5654	18.7092	17.5582	16.5779 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Living area fraction									fLA = Living area / (4) =			0.1117 (91)
MIT	16.8370	17.2615	17.9242	18.7645	19.4239	19.8390	19.9880	19.9651	19.6837	18.8508	17.7376	16.7914 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6870	17.1115	17.7742	18.6145	19.2739	19.6890	19.8380	19.8151	19.5337	18.7008	17.5876	16.6414 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8888	0.8564	0.8060	0.7226	0.6071	0.4611	0.3278	0.3669	0.5619	0.7525	0.8555	0.8982	(94)
Useful gains	778.6833	861.9015	909.9659	905.5411	811.2930	607.6147	412.3081	428.0355	603.6347	717.3894	735.1283	746.1626	(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													
	1732.4923	1700.9315	1563.8968	1319.6344	1024.5056	683.9735	435.1945	458.9986	730.3084	1095.7748	1430.6882	1711.5124	(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													
	709.6339	563.8282	486.5246	298.1472	158.6302	0.0000	0.0000	0.0000	0.0000	281.5187	500.8031	718.2202	(98)
Space heating													3717.3061 (98)
Space heating per m2											(98) / (4) =		32.7458 (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	4102.9869 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	709.6339	563.8282	486.5246	298.1472	158.6302	0.0000	0.0000	0.0000	0.0000	281.5187	500.8031	718.2202	(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)	783.2604	622.3269	537.0029	329.0808	175.0885	0.0000	0.0000	0.0000	0.0000	310.7271	552.7628	792.7376	(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	174.8820	132.4925	107.4692	55.6039	21.1842	5.2064	0.0000	30.9891	61.2929	112.4969	150.7527	174.0747	(64)
Efficiency of water heater (217)m	88.2630	88.3488	88.4568	88.7322	89.1928	79.9000	79.9000	79.9000	79.9000	87.2635	87.8771	79.9000	(216)
Fuel for water heating, kWh/month	198.1373	149.9653	121.4935	62.6648	23.7510	6.5162	0.0000	38.7849	76.7120	128.9163	171.5494	197.1550	(219)
Water heating fuel used												1175.6456	(219)
Annual totals kWh/year													
Space heating fuel - main system												4102.9869	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)													
mechanical ventilation fans (SFP = 0.2302)												81.1539	(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												206.1539	(231)
Electricity for lighting (calculated in Appendix L)												443.6236	(232)

Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.99 + 1004 + 1.00) =									-795.1650			-795.1650	(233)
Total delivered energy for all uses												5133.2450	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4102.9869	3.4800	142.7839	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1175.6456	3.4800	40.9125	(247)
Mechanical ventilation fans	81.1539	13.1900	10.7042	(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	443.6236	13.1900	58.5140	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-795.1650	13.1900	-104.8823	(252)
Total energy cost			284.5198	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.7538 (257)
 SAP value 89.4840
 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	4102.9869	0.2160	886.2452 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1175.6456	0.2160	253.9395 (264)
Space and water heating			1140.1846 (265)
Pumps and fans	206.1539	0.5190	106.9939 (267)
Energy for lighting	443.6236	0.5190	230.2407 (268)
Energy saving/generation technologies			
PV Unit	-795.1650	0.5190	-412.6906 (269)
Total kg/year			1064.7285 (272)
CO2 emissions per m2			9.3800 (273)
EI value			90.9996
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =		0.0000 (8)	
Pressure test														Yes			
Measured/design AP50														4.8200			
Infiltration rate														0.2410 (18)			
Number of sides sheltered														0 (19)			
Shelter factor										(20) = 1 - [0.075 x (19)] =				1.0000 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.2410 (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																	
	0.2651	0.2470	0.2470	0.2350	0.2350	0.2229	0.2229	0.2109	0.2109	0.2290	0.2229	0.2350 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:														0.5000 (23a)			
Effective ac	0.5151	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)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum(A, m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			18.0000	1021.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10164.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							89.5433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1282 (36)
Total fabric heat loss						(33) + (36) =	86.7328 (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	49.1095	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699 (38)
Heat transfer coeff	135.8423	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026 (39)
Average = Sum(39)m / 12 =												134.5226 (39)
HLP	1.1966	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840 (40)
HLP (average)												1.1850 (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 2.8344 (42)
 Average daily hot water use (litres/day) 101.5166 (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 EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1597.2519 (45)
	24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526	24.0563 (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	201.9576	177.6739	184.4183	158.7309	148.5889	130.4656	123.3042	138.9824	145.8733	170.2553	182.8682	196.7323 (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												1.2628 (H8)
Utilisation factor												0.5470 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												101.5166 (H14)
Volume ratio Veff/V												1.0786 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-970.1482 (H17)
Solar input	-31.8478	-45.2856	-77.8350	-105.0175	-122.7387	-132.3345	-125.9720	-114.8153	-89.7168	-61.6990	-37.6676	-25.2183 (63)
												-970.1482 (63)
Output from w/h												
	170.1098	132.3883	106.5833	53.7134	25.8502	0.0000	0.0000	24.1671	56.1565	108.5563	145.2007	171.5141 (64)
												994.2395 (64)
Heat gains from water heating, kWh/month	84.1477	74.4285	77.6634	66.0692	60.4212	53.9347	51.9053	57.5533	62.4255	72.9542	77.2522	82.4103 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7995	55.7780	45.3617	34.3417	25.6708	21.6724	23.4178	30.4393	40.8556	51.8756	60.5465	64.5449 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	412.7156	416.9983	406.2060	383.2306	354.2282	326.9701	308.7600	304.4773	315.2695	338.2450	367.2473	394.5055 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407 (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)	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754 (71)
Water heating gains (Table 5)	113.1017	110.7567	104.3862	91.7628	81.2113	74.9092	69.7652	77.3566	86.7021	98.0567	107.2947	110.7665 (72)
Total internal gains	703.1452	698.0613	670.4823	623.8634	575.6388	538.0801	516.4714	526.8016	557.3556	602.7056	649.6169	684.3452 (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		9.6400	45.1778	0.7200	0.7000	0.7700	152.1129 (77)
Southwest		0.6000	45.1778	0.7200	0.7000	0.7700	9.4676 (79)
Northwest		5.2800	14.6176	0.7200	0.7000	0.7700	26.9572 (81)
Northwest		5.2200	14.6176	0.7200	0.7000	0.7700	26.6509 (81)

Solar gains	215.1887	327.6693	494.1777	687.0476	788.2963	886.8526	813.3659	730.4556	585.9176	397.7960	260.2492	172.2770 (83)
Total gains	918.3338	1025.7306	1164.6601	1310.9110	1363.9350	1424.9327	1329.8373	1257.2572	1143.2732	1000.5016	909.8661	856.6223 (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	20.7859	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085
alpha	2.3857	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006
util living area	0.9181	0.8934	0.8395	0.7471	0.6136	0.4341	0.3172	0.3335	0.5564	0.7695	0.8815	0.9267 (86)
MIT	18.8933	19.1538	19.6344	20.1722	20.6269	20.8889	20.9640	20.9598	20.7844	20.2707	19.5215	18.8614 (87)
Th 2	19.9227	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329 (88)
util rest of house												
	0.9068	0.8790	0.8176	0.7123	0.5582	0.3563	0.2207	0.2328	0.4786	0.7280	0.8626	0.9163 (89)
MIT 2	17.1659	17.5415	18.2194	18.9582	19.5515	19.8496	19.9169	19.9149	19.7495	19.1122	18.0740	17.1273 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Living area fraction									fLA = Living area / (4) =		0.1117 (91)	
MIT	17.3588	17.7216	18.3775	19.0938	19.6716	19.9657	20.0339	20.0316	19.8651	19.2416	18.2356	17.3210 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2088	17.5716	18.2275	18.9438	19.5216	19.8157	19.8839	19.8816	19.7151	19.0916	18.0856	17.1710 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8669	0.8366	0.7740	0.6748	0.5346	0.3473	0.2161	0.2278	0.4611	0.6886	0.8191	0.8782	(94)
Useful gains	796.0739	858.1774	901.4356	884.5596	729.1878	494.8361	287.3994	286.3411	527.1479	688.9720	745.2367	752.2837	(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													
Month fracti	1604.1375	1568.6940	1428.3639	1202.0746	863.0851	526.2784	293.5191	293.2152	593.3949	953.1341	1301.7767	1568.6166	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	601.1994	477.4672	392.0347	228.6108	99.6196	0.0000	0.0000	0.0000	0.0000	196.5366	400.7088	607.3516	(98)
Space heating per m2												3003.5287	(98)
												(98) / (4) =	26.4581 (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													3315.1530 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	601.1994	477.4672	392.0347	228.6108	99.6196	0.0000	0.0000	0.0000	0.0000	196.5366	400.7088	607.3516	(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)	663.5754	527.0057	432.7094	252.3298	109.9554	0.0000	0.0000	0.0000	0.0000	216.9278	442.2835	670.3660	(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	170.1098	132.3883	106.5833	53.7134	25.8502	0.0000	0.0000	24.1671	56.1565	108.5563	145.2007	171.5141	(64)
Efficiency of water heater (217)m	88.0009	88.0406	88.0787	88.3490	88.1674	79.9000	79.9000	79.9000	79.9000	86.4793	87.4839	79.9000	(216)
Fuel for water heating, kWh/month	193.3046	150.3720	121.0092	60.7968	29.3194	0.0000	0.0000	30.2467	70.2834	125.5286	165.9742	194.8919	(219)
Water heating fuel used												1141.7267	(219)
Annual totals kWh/year													
Space heating fuel - main system												3315.1530	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)													
mechanical ventilation fans (SFP = 0.2302)													81.1539 (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													206.1539 (231)
Electricity for lighting (calculated in Appendix L)													443.6236 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.99 + 1115 + 1.00) =										-882.9989			-882.9989 (233)
Total delivered energy for all uses													4223.6583 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3315.1530	7.6100	252.2831	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1141.7267	7.6100	86.8854	(247)
Mechanical ventilation fans	81.1539	31.0800	25.2226	(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	443.6236	31.0800	137.8782	(250)
Additional standing charges			105.0000	(251)
Energy saving/generation technologies				
PV Unit	-882.9989	31.0800	-274.4361	(252)
Total energy cost			371.6833	(255)

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3315.1530	0.2160	716.0731 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1141.7267	0.2160	246.6130 (264)
Space and water heating			962.6860 (265)
Pumps and fans	206.1539	0.5190	106.9939 (267)
Energy for lighting	443.6236	0.5190	230.2407 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	0.5190	-458.2764 (269)
Total kg/year			841.6441 (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	3315.1530	1.2200	4044.4867 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1141.7267	1.2200	1392.9065 (264)
Space and water heating			5437.3933 (265)
Pumps and fans	206.1539	3.0700	632.8923 (267)
Energy for lighting	443.6236	3.0700	1361.9245 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	3.0700	-2710.8066 (269)
Primary energy kWh/year			4721.4035 (272)
Primary energy kWh/m2/year			41.5909 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	89.5 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	381.36 (P1)
Transmission heat loss coefficient	86.73 (37)
Summer heat loss coefficient	468.09 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Shading	Gains W
South East	9.6400	127.3119	0.7200	0.7000	0.9000	501.0274
South West	0.6000	127.3119	0.7200	0.7000	0.9000	31.1843
North West	5.2800	106.0502	0.7200	0.7000	0.9000	228.5920
North West	5.2200	106.0502	0.7200	0.7000	0.9000	225.9944

total: 986.7980

	Jun	Jul	Aug	
Solar gains	1063	987	867	(P3)
Internal gains	557	535	544	
Total summer gains	1620	1522	1412	(P5)

Summer gain/loss ratio	3.46	3.25	3.02	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 89.5)	1.37	1.37	1.37	
Threshold temperature	20.23	21.92	21.69	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight