

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-P637-6633-623			Issued on Date	05/12/2023
Assessment Reference	As Built	Prop Type Ref	2C-As-SEMI		
Property	6, Fulmar Drive, BOTLEY, SO32 2TP				
SAP Rating	92 A	DER	9.16	TER	17.39
Environmental	93 A	% DER<TER	47.32		
CO ₂ Emissions (t/year)	0.54	DFEE	43.40	TFEE	50.37
General Requirements Compliance	Pass	% DFEE<TFEE	13.84		
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk			Assessor ID	Q919-0001
Client					

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 94 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.39 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.16 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.30 (max. 2.00)	1.30 (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: 4.96 (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 COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading:
Average
Windows facing North East: 4.12 m², No overhang
Windows facing South East: 1.54 m², No overhang
Windows facing South West: 7.82 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.035 W/m²K
Photovoltaic array 1.48 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	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.9900 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.3715 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3436 (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	0.4381	0.4295	0.4209	0.3780	0.3694	0.3264	0.3264	0.3178	0.3436	0.3694	0.3866	0.4037 (22b)
Effective ac	0.5960	0.5922	0.5886	0.5714	0.5682	0.5533	0.5533	0.5505	0.5590	0.5682	0.5747	0.5815 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13531.9470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 143.9569 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7214 (36)
Total fabric heat loss (33) + (36) = 60.4807 (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	47.7883	47.4895	47.1966	45.8209	45.5635	44.3654	44.3654	44.1435	44.8269	45.5635	46.0842	46.6286 (38)
Heat transfer coeff	108.2690	107.9702	107.6773	106.3016	106.0442	104.8460	104.8460	104.6241	105.3075	106.0442	106.5649	107.1092 (39)
Average = Sum(39)m / 12 =												106.3004 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1518	1.1486	1.1455	1.1309	1.1281	1.1154	1.1154	1.1130	1.1203	1.1281	1.1337	1.1395 (40)
HLP (average)												1.1309 (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 2.6766 (42)
Average daily hot water use (litres/day) 97.7695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

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Energy content (annual)	Total = Sum(45)m = 1538.2950 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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)
Combi loss	14.1393	12.7601	14.1011	13.6014	14.0221	13.5322	13.9599	14.0003	13.5699	14.0684	13.6542 (61)
Total heat required for water heating calculated for each month											
173.6276	152.2495	158.0417	139.0923	134.4337	117.4382	110.2441	124.4878	125.3770	144.3688	155.8872	168.5831 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
173.6276	152.2495	158.0417	139.0923	134.4337	117.4382	110.2441	124.4878	125.3770	144.3688	155.8872	168.5831 (64)
Heat gains from water heating, kWh/month											
56.5647	49.5703	51.3855	45.1261	43.5424	37.9318	35.5045	40.2372	40.5683	46.8420	50.7060	54.8884 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4295	20.8099	16.9237	12.8124	9.5774	8.0856	8.7368	11.3564	15.2426	19.3540	22.5889	24.0807	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	(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)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	76.0278	73.7653	69.0666	62.6751	58.5247	52.6831	47.7211	54.0822	56.3449	62.9597	70.4250	73.7747	(72)
Total internal gains	411.8538	409.5270	394.5029	370.2917	345.6020	322.0051	306.8291	313.2546	325.8427	350.2772	378.2818	399.3869	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast					4.1200	11.2829	0.4600		0.0000	0.7700		16.4652 (75)
Southeast					1.5400	36.7938	0.4600		0.0000	0.7700		20.0699 (77)
Southwest					4.4900	36.7938	0.4600		0.0000	0.7700		58.5154 (79)
Southwest					3.3300	36.7938	0.4600		0.0000	0.7700		43.3978 (79)

Solar gains	138.4483	241.2977	344.6809	451.4257	527.8592	533.8180	510.5892	452.0718	381.4123	270.6022	166.8251	117.8384 (83)
Total gains	550.3021	650.8247	739.1838	821.7174	873.4613	855.8231	817.4184	765.3264	707.2550	620.8794	545.1069	517.2253 (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	34.7179	34.8140	34.9087	35.3605	35.4463	35.8514	35.8514	35.9274	35.6943	35.4463	35.2731	35.0938
alpha	3.3145	3.3209	3.3272	3.3574	3.3631	3.3901	3.3901	3.3952	3.3796	3.3631	3.3515	3.3396
util living area	0.9864	0.9757	0.9545	0.9065	0.8152	0.6710	0.5259	0.5733	0.7820	0.9311	0.9775	0.9889 (86)
MIT	19.0991	19.3409	19.7120	20.1820	20.5854	20.8531	20.9523	20.9354	20.7370	20.2064	19.5680	19.0584 (87)
Th 2	19.9588	19.9613	19.9638	19.9757	19.9779	19.9883	19.9883	19.9902	19.9843	19.9779	19.9734	19.9687 (88)
util rest of house	0.9837	0.9708	0.9449	0.8859	0.7727	0.5947	0.4196	0.4675	0.7183	0.9116	0.9722	0.9866 (89)
MIT 2	17.4193	17.7713	18.3078	18.9810	19.5286	19.8638	19.9611	19.9505	19.7364	19.0290	18.1115	17.3662 (90)
Living area fraction	fLA = Living area / (4) =											0.1809 (91)
MIT	17.7231	18.0552	18.5617	19.1982	19.7197	20.0427	20.1404	20.1286	19.9174	19.2419	18.3749	17.6723 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5731	17.9052	18.4117	19.0482	19.5697	19.8927	19.9904	19.9786	19.7674	19.0919	18.2249	17.5223 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9740	0.9567	0.9254	0.8624	0.7529	0.5867	0.4199	0.4662	0.7023	0.8892	0.9586	0.9782	(94)
Useful gains	535.9753	622.6447	684.0517	708.6745	657.6548	502.1206	343.2115	356.7688	496.7318	552.0863	522.5566	505.9615	(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	1437.0610	1404.1720	1282.6219	1078.7736	834.5354	554.9195	355.4663	374.4116	596.8167	900.5170	1185.5287	1426.9379	(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	670.4078	525.1863	445.3362	266.4714	131.5991	0.0000	0.0000	0.0000	0.0000	259.2324	477.3399	685.2064	(98)
Space heating												3460.7796	(98)
Space heating per m2												(98) / (4) =	36.8168 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3824.0659 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	670.4078	525.1863	445.3362	266.4714	131.5991	0.0000	0.0000	0.0000	0.0000	259.2324	477.3399	685.2064 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	740.7821	580.3164	492.0842	294.4435	145.4134	0.0000	0.0000	0.0000	0.0000	286.4447	527.4474	757.1342 (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	173.6276	152.2495	158.0417	139.0923	134.4337	117.4382	110.2441	124.4878	125.3770	144.3688	155.8872	168.5831 (64)
Efficiency of water heater (217)m	89.8227	89.7605	89.6394	89.3764	88.8542	87.3000	87.3000	87.3000	87.3000	89.3288	89.6907	87.3000 (216)
Fuel for water heating, kWh/month	193.3004	169.6174	176.3084	155.6253	151.2970	134.5226	126.2819	142.5977	143.6163	161.6152	173.8054	187.6279 (219)
Water heating fuel used												1916.2154 (219)
Annual totals kWh/year												
Space heating fuel - main system												3824.0659 (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)												413.7723 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.48 * 1029 * 1.00) =	-1218.5571											-1218.5571 (233)
Total delivered energy for all uses												5010.4966 (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	3824.0659	0.2160	825.9982 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.2154	0.2160	413.9025 (264)
Space and water heating			1239.9008 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	413.7723	0.5190	214.7478 (268)
Energy saving/generation technologies			
PV Unit	-1218.5571	0.5190	-632.4311 (269)
Total CO2, kg/year			861.1425 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.1600 (273)

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

DER	9.1600 ZC1
Total Floor Area	TFA 94.0000
Assumed number of occupants	N 2.6766
CO2 emission factor in Table 12 for electricity displaced from grid	EF 0.5190
CO2 emissions from appliances, equation (L14)	15.5235 ZC2
CO2 emissions from cooking, equation (L16)	1.9493 ZC3
Total CO2 emissions	26.6329 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	26.6329 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.9900 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1235 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3735 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3455 (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	0.4405	0.4318	0.4232	0.3800	0.3714	0.3282	0.3282	0.3195	0.3455	0.3714	0.3886	0.4059	(22b)				
Effective ac	0.5970	0.5932	0.5895	0.5722	0.5690	0.5539	0.5539	0.5511	0.5597	0.5690	0.5755	0.5824	(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			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			13.4800	1.3258	17.8712		(27)					
GF B&B J150 P/A=0.40			47.0000	0.1300	6.1100		(28a)					
EW Brick AAC015	100.3000	15.6100	84.6900	0.1800	15.2442		(29a)					
Plane Ceiling	47.0000		47.0000	0.1300	6.1100		(30)					
Total net area of external elements Aum(A, m2)			194.3000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		47.4654		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0340 (36)					
Total fabric heat loss						(33) + (36) =	57.4994 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.8714	Feb 47.5693	Mar 47.2733	Apr 45.8828	May 45.6226	Jun 44.4115	Jul 44.4115	Aug 44.1872	Sep 44.8780	Oct 45.6226	Nov 46.1489	Dec 46.6991 (38)
Heat transfer coeff	105.3708	105.0687	104.7727	103.3822	103.1220	101.9109	101.9109	101.6866	102.3774	103.1220	103.6483	104.1985 (39)
Average = Sum(39)m / 12 =												103.3809 (39)
HLP	Jan 1.1210	Feb 1.1178	Mar 1.1146	Apr 1.0998	May 1.0970	Jun 1.0842	Jul 1.0842	Aug 1.0818	Sep 1.0891	Oct 1.0970	Nov 1.1026	Dec 1.1085 (40)
HLP (average)												1.0998 (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												2.6766 (42)
Average daily hot water use (litres/day)												97.7695 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)
Energy content (annual)											Total = Sum(45)m =	1538.2950 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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												

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Combi 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)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.8187	47.2508	46.8329	43.3936	44.8400	46.8329	47.2508	50.8187	49.3151	50.9589 (61)
Solar input	210.4472	185.5169	194.7594	172.7417	167.2445	147.2996	141.1242	157.3204	159.0579	181.1191	191.5481	205.4148 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	210.4472	185.5169	194.7594	172.7417	167.2445	147.2996	141.1242	157.3204	159.0579	181.1191	191.5481	205.4148 (64)
	65.7696	57.8871	60.5649	53.5384	51.7451	45.3971	43.2245	48.4453	48.9886	56.0296	59.6213	64.0963 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4295	20.8099	16.9237	12.8124	9.5774	8.0856	8.7368	11.3564	15.2426	19.3540	22.5889	24.0807	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	(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)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	88.4000	86.1415	81.4045	74.3589	69.5498	63.0516	58.0975	65.1147	68.0397	75.3085	82.8073	86.1510	(72)
Total internal gains	424.2260	421.9032	406.8408	381.9756	356.6272	332.3736	317.2055	324.2871	337.5375	362.6260	390.6641	411.7631	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				4.1200	11.2829	0.6300	0.7000	0.7700	14.2066 (75)			
Southeast				1.5400	36.7938	0.6300	0.7000	0.7700	17.3168 (77)			
Southwest				7.8200	36.7938	0.6300	0.7000	0.7700	87.9333 (79)			
Solar gains	119.4568	208.1980	297.3997	389.5018	455.4507	460.5921	440.5497	390.0593	329.0925	233.4826	143.9410	101.6740 (83)
Total gains	543.6828	630.1012	704.2405	771.4774	812.0779	792.9657	757.7552	714.3464	666.6300	596.1087	534.6051	513.4371 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.9506	62.1286	62.3042	63.1422	63.3015	64.0538	64.0538	64.1951	63.7619	63.3015	62.9801	62.6475	
alpha	5.1300	5.1419	5.1536	5.2095	5.2201	5.2703	5.2703	5.2797	5.2508	5.2201	5.1987	5.1765	
util living area	0.9983	0.9961	0.9897	0.9675	0.9002	0.7487	0.5760	0.6288	0.8633	0.9787	0.9964	0.9988	(86)
MIT	19.7777	19.9307	20.1732	20.4913	20.7700	20.9408	20.9879	20.9812	20.8678	20.5066	20.0849	19.7540	(87)
Th 2	19.9837	19.9864	19.9889	20.0010	20.0032	20.0138	20.0138	20.0157	20.0097	20.0032	19.9987	19.9939	(88)
util rest of house	0.9978	0.9947	0.9860	0.9548	0.8606	0.6609	0.4550	0.5071	0.7967	0.9681	0.9949	0.9983	(89)
MIT 2	18.3506	18.5757	18.9301	19.3939	19.7707	19.9728	20.0091	20.0077	19.9003	19.4231	18.8103	18.3231	(90)
Living area fraction	18.6087	18.8208	19.1549	19.5924	19.9514	20.1479	20.1862	20.1838	20.0753	19.6191	19.0408	18.5819	(91)
MIT	18.6087	18.8208	19.1549	19.5924	19.9514	20.1479	20.1862	20.1838	20.0753	19.6191	19.0408	18.5819	(92)
Temperature adjustment	18.6087	18.8208	19.1549	19.5924	19.9514	20.1479	20.1862	20.1838	20.0753	19.6191	19.0408	18.5819	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9966	0.9925	0.9816	0.9480	0.8582	0.6739	0.4769	0.5289	0.8019	0.9624	0.9927	0.9974	(94)
Ext temp.	541.8229	625.3520	691.3117	731.3922	696.8991	534.3831	361.3714	377.8468	534.5436	573.7094	530.7186	512.1164	(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	1507.7178	1462.6384	1325.8874	1105.3995	850.9052	565.3902	365.4683	384.7571	611.7350	930.0661	1237.6482	1498.5735	(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	718.6258	562.6565	472.1243	269.2852	114.5806	0.0000	0.0000	0.0000	0.0000	265.1294	508.9893	733.9241	(98)
Space heating per m2												3645.3152	(98)
												38.7799	(99)

8c. Space cooling requirement

Not applicable

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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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3902.9071 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	718.6258	562.6565	472.1243	269.2852	114.5806	0.0000	0.0000	0.0000	0.0000	265.1294	508.9893	733.9241	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	769.4066	602.4159	505.4864	288.3139	122.6773	0.0000	0.0000	0.0000	0.0000	283.8644	544.9565	785.7860	(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	210.4472	185.5169	194.7594	172.7417	167.2445	147.2996	141.1242	157.3204	159.0579	181.1191	191.5481	205.4148	(64)
Efficiency of water heater (217)m	87.8958	87.6659	87.1970	86.1647	84.1211	80.3000	80.3000	80.3000	80.3000	86.0093	87.3944	80.3000	(216)
Fuel for water heating, kWh/month	239.4280	211.6181	223.3555	200.4785	198.8139	183.4366	175.7462	195.9159	198.0796	210.5809	219.1767	233.4787	(219)
Water heating fuel used												2490.1088	(219)
Annual totals kWh/year													
Space heating fuel - main system												3902.9071	(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)												413.7723	(232)
Total delivered energy for all uses												6881.7882	(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	3902.9071	0.2160	843.0279 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2490.1088	0.2160	537.8635 (264)
Space and water heating			1380.8914 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	413.7723	0.5190	214.7478 (268)
Total CO2, kg/m2/year			1634.5643 (272)
Emissions per m2 for space and water heating			14.6903 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2846 (272b)
Emissions per m2 for pumps and fans			0.4141 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6903 * 1.00) + 2.2846 + 0.4141, rounded to 2 d.p.			17.3900 (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	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.9900 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.3715 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3436 (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	0.4381	0.4295	0.4209	0.3780	0.3694	0.3264	0.3264	0.3178	0.3436	0.3694	0.3866	0.4037 (22b)
Effective ac	0.5960	0.5922	0.5886	0.5714	0.5682	0.5533	0.5533	0.5505	0.5590	0.5682	0.5747	0.5815 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13531.9470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							143.9569 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7214 (36)
Total fabric heat loss							(33) + (36) = 60.4807 (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	47.7883	47.4895	47.1966	45.8209	45.5635	44.3654	44.3654	44.1435	44.8269	45.5635	46.0842	46.6286 (38)
Heat transfer coeff	108.2690	107.9702	107.6773	106.3016	106.0442	104.8460	104.8460	104.6241	105.3075	106.0442	106.5649	107.1092 (39)
Average = Sum(39)m / 12 =												106.3004 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1518	1.1486	1.1455	1.1309	1.1281	1.1154	1.1154	1.1130	1.1203	1.1281	1.1337	1.1395 (40)
HLP (average)												1.1309 (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												2.6766 (42)
Average daily hot water use (litres/day)												97.7695 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1538.2950 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.8913	29.6415	30.5874	26.6668	25.5875	22.0800	20.4604	23.4786	23.7590	27.6888	30.2245	32.8219 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4295	20.8099	16.9237	12.8124	9.5774	8.0856	8.7368	11.3564	15.2426	19.3540	22.5889	24.0807	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	(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)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	45.5528	44.1094	41.1121	37.0373	34.3917	30.6667	27.5005	31.5573	32.9986	37.2162	41.9785	44.1154	(72)
Total internal gains	378.3788	376.8711	363.5484	341.6539	318.4691	296.9887	283.6086	287.7297	299.4964	321.5337	346.8353	366.7276	(73)

6. Solar gains

[Jan]				Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				4.1200		11.2829		0.4600		0.0000		0.7700		16.4652 (75)
Southeast				1.5400		36.7938		0.4600		0.0000		0.7700		20.0699 (77)
Southwest				4.4900		36.7938		0.4600		0.0000		0.7700		58.5154 (79)
Southwest				3.3300		36.7938		0.4600		0.0000		0.7700		43.3978 (79)
Solar gains	138.4483	241.2977	344.6809	451.4257	527.8592	533.8180	510.5892	452.0718	381.4123	270.6022	166.8251	117.8384		(83)
Total gains	516.8271	618.1688	708.2293	793.0795	846.3283	830.8067	794.1978	739.8015	680.9088	592.1359	513.6604	484.5660		(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	34.7179	34.8140	34.9087	35.3605	35.4463	35.8514	35.8514	35.9274	35.6943	35.4463	35.2731	35.0938	
alpha	3.3145	3.3209	3.3272	3.3574	3.3631	3.3901	3.3901	3.3952	3.3796	3.3631	3.3515	3.3396	
util living area	0.9887	0.9790	0.9593	0.9139	0.8259	0.6839	0.5383	0.5883	0.7961	0.9388	0.9810	0.9908	(86)
MIT	19.0512	19.2961	19.6727	20.1516	20.5656	20.8440	20.9488	20.9301	20.7203	20.1728	19.5243	19.0111	(87)
Th 2	19.9588	19.9613	19.9638	19.9757	19.9779	19.9883	19.9883	19.9902	19.9843	19.9779	19.9734	19.9687	(88)
util rest of house	0.9864	0.9746	0.9506	0.8945	0.7847	0.6079	0.4307	0.4814	0.7340	0.9210	0.9764	0.9889	(89)
MIT 2	18.1775	18.4220	18.7952	19.2686	19.6547	19.8974	19.9682	19.9606	19.8027	19.2988	18.6594	18.1450	(90)
Living area fraction	18.3355	18.5801	18.9539	19.4283	19.8195	20.0685	20.1455	20.1359	19.9686	19.4569	18.8158	18.3016	(92)
Temperature adjustment	18.3355	18.5801	18.9539	19.4283	19.8195	20.0685	20.1455	20.1359	19.9686	19.4569	18.8158	18.3016	(93)
adjusted MIT	18.3355	18.5801	18.9539	19.4283	19.8195	20.0685	20.1455	20.1359	19.9686	19.4569	18.8158	18.3016	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	507.1778	597.7713	665.5895	699.5134	657.9292	510.4849	356.0985	368.3757	499.0656	538.6054	497.9220	477.1259	(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	1519.6132	1477.0399	1341.0021	1119.1757	861.0212	573.3557	371.7368	390.8683	618.0099	939.2188	1248.4909	1510.4157	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	753.2519	590.8685	502.5070	302.1568	151.1004	0.0000	0.0000	0.0000	0.0000	298.0564	540.4096	768.7676	(98)
Space heating													3907.1183 (98)
Space heating per m2													41.5651 (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													

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	985.5527	775.8606	795.1435	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8040	0.8669	0.8414	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	792.3375	672.5856	669.0142	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1073.2673	1028.3620	966.7569	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	202.2695	264.6977	221.5206	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			688.4878 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	50.5674	66.1744	55.3802	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												172.1220 (107)
Energy for space heating												1.8311 (108)
Energy for space cooling												41.5651 (99)
Total												1.8311 (108)
Dwelling Fabric Energy Efficiency (DFEE)												43.3962 (109)
												43.4 (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	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.9900 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3735 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3455 (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	0.4405	0.4318	0.4232	0.3800	0.3714	0.3282	0.3282	0.3195	0.3455	0.3714	0.3886	0.4059 (22b)
Effective ac	0.5970	0.5932	0.5895	0.5722	0.5690	0.5539	0.5539	0.5511	0.5597	0.5690	0.5755	0.5824 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Opening Type (Uw = 1.40)			13.4800	1.3258	17.8712		(27)
GF B&B J150 P/A=0.40			47.0000	0.1300	6.1100		(28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.1800	15.2442		(29a)
Plane Ceiling	47.0000		47.0000	0.1300	6.1100		(30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.4654		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0340 (36)
Total fabric heat loss						(33) + (36) =	57.4994 (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	47.8714	47.5693	47.2733	45.8828	45.6226	44.4115	44.4115	44.1872	44.8780	45.6226	46.1489	46.6991 (38)
Heat transfer coeff	105.3708	105.0687	104.7727	103.3822	103.1220	101.9109	101.9109	101.6866	102.3774	103.1220	103.6483	104.1985 (39)
Average = Sum(39)m / 12 =												103.3809 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1210	1.1178	1.1146	1.0998	1.0970	1.0842	1.0842	1.0818	1.0891	1.0970	1.1026	1.1085 (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												2.6766 (42)
Average daily hot water use (litres/day)												97.7695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)
Energy content (annual)										Total = Sum(45)m =		1538.2950 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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	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	0.0000 (59)
	33.8913	29.6415	30.5874	26.6668	25.5875	22.0800	20.4604	23.4786	23.7590	27.6888	30.2245	32.8219	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4295	20.8099	16.9237	12.8124	9.5774	8.0856	8.7368	11.3564	15.2426	19.3540	22.5889	24.0807	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	(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)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	45.5528	44.1094	41.1121	37.0373	34.3917	30.6667	27.5005	31.5573	32.9986	37.2162	41.9785	44.1154	(72)
Total internal gains	378.3788	376.8711	363.5484	341.6539	318.4691	296.9887	283.6086	287.7297	299.4964	321.5337	346.8353	366.7276	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
Northeast				4.1200	11.2829	0.6300	0.7000	0.7700			14.2066 (75)	
Southeast				1.5400	36.7938	0.6300	0.7000	0.7700			17.3168 (77)	
Southwest				7.8200	36.7938	0.6300	0.7000	0.7700			87.9333 (79)	
Solar gains	119.4568	208.1980	297.3997	389.5018	455.4507	460.5921	440.5497	390.0593	329.0925	233.4826	143.9410	101.6740 (83)
Total gains	497.8356	585.0690	660.9481	731.1557	773.9198	757.5808	724.1583	677.7890	628.5889	555.0163	490.7763	468.4016 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.9506	62.1286	62.3042	63.1422	63.3015	64.0538	64.0538	64.1951	63.7619	63.3015	62.9801	62.6475	
alpha	5.1300	5.1419	5.1536	5.2095	5.2201	5.2703	5.2703	5.2797	5.2508	5.2201	5.1987	5.1765	
util living area	0.9989	0.9972	0.9922	0.9737	0.9145	0.7716	0.5994	0.6567	0.8847	0.9842	0.9976	0.9992	(86)
MIT	19.7320	19.8863	20.1318	20.4565	20.7465	20.9316	20.9855	20.9771	20.8482	20.4692	20.0414	19.7089	(87)
Th 2	19.9837	19.9864	19.9889	20.0010	20.0032	20.0138	20.0138	20.0157	20.0097	20.0032	19.9987	19.9939	(88)
util rest of house	0.9985	0.9962	0.9893	0.9631	0.8785	0.6852	0.4751	0.5324	0.8235	0.9760	0.9965	0.9989	(89)
MIT 2	18.8231	18.9791	19.2253	19.5538	19.8253	19.9808	20.0099	20.0089	19.9215	19.5715	19.1442	18.8082	(90)
Living area fraction									fLA = Living area / (4) =			0.1809	(91)
MIT	18.9875	19.1432	19.3892	19.7171	19.9919	20.1527	20.1863	20.1840	20.0891	19.7338	19.3065	18.9711	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9875	19.1432	19.3892	19.7171	19.9919	20.1527	20.1863	20.1840	20.0891	19.7338	19.3065	18.9711	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9980	0.9951	0.9870	0.9593	0.8780	0.6986	0.4978	0.5550	0.8294	0.9730	0.9955	0.9985	(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	(95)
Heat loss rate W	1547.6337	1496.5118	1350.4389	1118.2935	855.0775	565.8824	365.4877	384.7785	613.1458	941.8994	1265.1809	1539.1249	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	781.7972	614.4097	519.3780	300.1910	130.6354	0.0000	0.0000	0.0000	0.0000	298.9813	559.1497	797.1315	(98)
Space heating												4001.6737	(98)
Space heating per m2												42.5710	(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	957.9624	754.1406	772.8182	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8531	0.9192	0.8953	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	817.2100	693.1896	691.8941	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	987.6786	946.4976	894.2749	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	122.7374	188.4612	150.5712	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												461.7698	(104)

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Calculation Type: New Build (As Built)



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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	30.6844	47.1153	37.6428	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												115.4425 (107)
Space cooling per m2												1.2281 (108)
Energy for space heating												42.5710 (99)
Energy for space cooling												1.2281 (108)
Total												43.7991 (109)
Target Fabric Energy Efficiency (TFEE)												50.4 (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	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.9900 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.3715 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3436 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3608	0.3350	0.3436	0.3264	0.3264	0.3178	0.3092	0.3007	0.2921	0.3178	0.3007	0.3178 (22b)
	0.5651	0.5561	0.5590	0.5533	0.5533	0.5505	0.5478	0.5452	0.5427	0.5505	0.5452	0.5505 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13531.9470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 143.9569 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7214 (36)
Total fabric heat loss (33) + (36) = 60.4807 (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	45.3121	44.5932	44.8269	44.3654	44.3654	44.1435	43.9275	43.7175	43.5133	44.1435	43.7175	44.1435 (38)
Heat transfer coeff	105.7927	105.0738	105.3075	104.8460	104.8460	104.6241	104.4082	104.1981	103.9940	104.6241	104.1981	104.6241 (39)
Average = Sum(39)m / 12 =												104.7114 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1255	1.1178	1.1203	1.1154	1.1154	1.1130	1.1107	1.1085	1.1063	1.1130	1.1085	1.1130 (40)
HLP (average)												1.1140 (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 2.6766 (42)
Average daily hot water use (litres/day) 97.7695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1538.2950 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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)
Combi loss	14.1393	12.7601	14.1011	13.6014	14.0221	13.5322	13.9599	14.0003	13.5699	14.0684	13.6542	14.1273 (61)
Total heat required for water heating calculated for each month	173.6276	152.2495	158.0417	139.0923	134.4337	117.4382	110.2441	124.4878	125.3770	144.3688	155.8872	168.5831 (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	173.6276	152.2495	158.0417	139.0923	134.4337	117.4382	110.2441	124.4878	125.3770	144.3688	155.8872	168.5831 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	56.5647	49.5703	51.3855	45.1261	43.5424	37.9318	35.5045	40.2372	40.5683	46.8420	50.7060	54.8884 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5738	52.0247	42.3093	32.0309	23.9435	20.2141	21.8420	28.3911	38.1065	48.3849	56.4723	60.2017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	367.5334	371.3472	361.7365	341.2763	315.4490	291.1749	274.9584	271.1445	280.7553	301.2155	327.0428	351.3169	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	(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)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	76.0278	73.7653	69.0666	62.6751	58.5247	52.6831	47.7211	54.0822	56.3449	62.9597	70.4250	73.7747	(72)
Total internal gains	612.4034	607.4057	583.3809	546.2508	508.1856	474.3406	454.7899	463.8863	485.4752	522.8285	564.2087	595.5618	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			4.1200		14.6176		0.4600		0.0000		0.7700		21.3316 (75)
Southeast			1.5400		45.1778		0.4600		0.0000		0.7700		24.6431 (77)
Southwest			4.4900		45.1778		0.4600		0.0000		0.7700		71.8489 (79)
Southwest			3.3300		45.1778		0.4600		0.0000		0.7700		53.2866 (79)
Solar gains	171.1102	254.2677	367.8458	488.1156	545.3413	600.2941	569.1876	514.3050	431.0642	308.0873	205.5918		143.1222 (83)
Total gains	783.5136	861.6734	951.2267	1034.3663	1053.5269	1074.6346	1023.9775	978.1913	916.5394	830.9158	769.8005		738.6839 (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	35.5306	35.7736	35.6943	35.8514	35.8514	35.9274	36.0017	36.0743	36.1451	35.9274	36.0743	35.9274
alpha	3.3687	3.3849	3.3796	3.3901	3.3901	3.3952	3.4001	3.4050	3.4097	3.3952	3.4050	3.3952
util living area	0.9591	0.9437	0.9054	0.8274	0.7039	0.5188	0.3871	0.4030	0.6308	0.8395	0.9326	0.9643 (86)
MIT	19.5597	19.7315	20.0710	20.4691	20.7729	20.9410	20.9835	20.9815	20.8829	20.5341	20.0161	19.5396 (87)
Th 2	19.9801	19.9863	19.9843	19.9883	19.9883	19.9902	19.9921	19.9939	19.9957	19.9902	19.9939	19.9902 (88)
util rest of house	0.9514	0.9334	0.8878	0.7952	0.6486	0.4387	0.2916	0.3044	0.5536	0.8018	0.9180	0.9574 (89)
MIT 2	18.0963	18.3451	18.8238	19.3724	19.7620	19.9474	19.9846	19.9854	19.8992	19.4730	18.7613	18.0750 (90)
Living area fraction	18.3610	18.5959	19.0494	19.5708	19.9448	20.1271	20.1652	20.1655	20.0771	19.6649	18.9883	18.3398 (92)
MIT	18.3610	18.5959	19.0494	19.5708	19.9448	20.1271	20.1652	20.1655	20.0771	19.6649	18.9883	18.3398 (92)
Temperature adjustment	18.2110	18.4459	18.8994	19.4208	19.7948	19.9771	20.0152	20.0155	19.9271	19.5149	18.8383	-0.1500
adjusted MIT	18.2110	18.4459	18.8994	19.4208	19.7948	19.9771	20.0152	20.0155	19.9271	19.5149	18.8383	18.1898 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9333	0.9128	0.8646	0.7744	0.6370	0.4376	0.2939	0.3065	0.5479	0.7807	0.8963	0.9405 (94)
Useful gains	731.2494	786.5695	822.4319	800.9755	671.0751	470.2988	300.9018	299.8644	502.1999	648.7198	689.9494	694.7360 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1408.2039	1381.2862	1253.0940	1040.1529	764.8326	489.3387	304.3759	303.7946	543.5893	849.0182	1139.7458	1379.9767 (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	503.6542	399.6496	320.4126	172.2077	69.7556	0.0000	0.0000	0.0000	0.0000	149.0221	323.8534	509.8191 (98)
Space heating												2448.3742 (98)
RHI space heating demand												2448 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.9900 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.3715 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3436 (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	0.4381	0.4295	0.4209	0.3780	0.3694	0.3264	0.3264	0.3178	0.3436	0.3694	0.3866	0.4037 (22b)
Effective ac	0.5960	0.5922	0.5886	0.5714	0.5682	0.5533	0.5533	0.5505	0.5590	0.5682	0.5747	0.5815 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13531.9470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							143.9569 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7214 (36)
Total fabric heat loss							(33) + (36) = 60.4807 (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	47.7883	47.4895	47.1966	45.8209	45.5635	44.3654	44.3654	44.1435	44.8269	45.5635	46.0842	46.6286 (38)
Heat transfer coeff	108.2690	107.9702	107.6773	106.3016	106.0442	104.8460	104.8460	104.6241	105.3075	106.0442	106.5649	107.1092 (39)
Average = Sum(39)m / 12 =												106.3004 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1518	1.1486	1.1455	1.1309	1.1281	1.1154	1.1154	1.1130	1.1203	1.1281	1.1337	1.1395 (40)
HLP (average)												1.1309 (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												2.6766 (42)
Average daily hot water use (litres/day)												97.7695 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1538.2950 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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)
Combi loss	14.1393	12.7601	14.1011	13.6014	14.0221	13.5322	13.9599	14.0003	13.5699	14.0684	13.6542 (61)
Total heat required for water heating calculated for each month											
173.6276	152.2495	158.0417	139.0923	134.4337	117.4382	110.2441	124.4878	125.3770	144.3688	155.8872	168.5831 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
173.6276	152.2495	158.0417	139.0923	134.4337	117.4382	110.2441	124.4878	125.3770	144.3688	155.8872	168.5831 (64)
Heat gains from water heating, kWh/month											
56.5647	49.5703	51.3855	45.1261	43.5424	37.9318	35.5045	40.2372	40.5683	46.8420	50.7060	54.8884 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5738	52.0247	42.3093	32.0309	23.9435	20.2141	21.8420	28.3911	38.1065	48.3849	56.4723	60.2017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	367.5334	371.3472	361.7365	341.2763	315.4490	291.1749	274.9584	271.1445	280.7553	301.2155	327.0428	351.3169	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	(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)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	76.0278	73.7653	69.0666	62.6751	58.5247	52.6831	47.7211	54.0822	56.3449	62.9597	70.4250	73.7747	(72)
Total internal gains	612.4034	607.4057	583.3809	546.2508	508.1856	474.3406	454.7899	463.8863	485.4752	522.8285	564.2087	595.5618	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					4.1200	11.2829	0.4600	0.0000	0.7700	16.4652 (75)		
Southeast					1.5400	36.7938	0.4600	0.0000	0.7700	20.0699 (77)		
Southwest					4.4900	36.7938	0.4600	0.0000	0.7700	58.5154 (79)		
Southwest					3.3300	36.7938	0.4600	0.0000	0.7700	43.3978 (79)		
Solar gains	138.4483	241.2977	344.6809	451.4257	527.8592	533.8180	510.5892	452.0718	381.4123	270.6022	166.8251	117.8384 (83)
Total gains	750.8517	848.7034	928.0618	997.6764	1036.0449	1008.1586	965.3792	915.9581	866.8875	793.4307	731.0338	713.4002 (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	34.7179	34.8140	34.9087	35.3605	35.4463	35.8514	35.8514	35.9274	35.6943	35.4463	35.2731	35.0938
alpha	3.3145	3.3209	3.3272	3.3574	3.3631	3.3901	3.3901	3.3952	3.3796	3.3631	3.3515	3.3396
util living area	0.9675	0.9504	0.9197	0.8572	0.7515	0.5983	0.4566	0.4956	0.6995	0.8784	0.9502	0.9720 (86)
MIT	19.3749	19.5990	19.9348	20.3486	20.6860	20.8971	20.9689	20.9585	20.8177	20.3862	19.8123	19.3327 (87)
Th 2	19.9588	19.9613	19.9638	19.9757	19.9779	19.9883	19.9883	19.9902	19.9843	19.9779	19.9734	19.9687 (88)
util rest of house	0.9614	0.9413	0.9046	0.8297	0.7033	0.5228	0.3600	0.3981	0.6297	0.8491	0.9394	0.9667 (89)
MIT 2	17.8166	18.1393	18.6187	19.2020	19.6475	19.9042	19.9712	19.9658	19.8205	19.2674	18.4584	17.7623 (90)
Living area fraction	fLA = Living area / (4) =											0.1809 (91)
MIT	18.0984	18.4033	18.8567	19.4094	19.8353	20.0838	20.1517	20.1454	20.0009	19.4697	18.7032	18.0463 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9484	18.2533	18.7067	19.2594	19.6853	19.9338	20.0017	19.9954	19.8509	19.3197	18.5532	17.8963 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9449	0.9212	0.8814	0.8070	0.6879	0.5185	0.3614	0.3986	0.6195	0.8259	0.9194	0.9516	(94)	
Useful gains	709.4626	781.8575	817.9549	805.0982	712.6780	522.7025	348.8630	365.1393	537.0471	655.2953	672.0891	678.8960	(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	1477.6990	1441.7565	1314.3829	1101.2211	846.7991	559.2226	356.6510	376.1616	605.6110	924.6782	1220.5099	1467.0006	(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	571.5679	443.4522	369.3424	213.2085	99.7861	0.0000	0.0000	0.0000	0.0000	200.4209	394.8629	586.3498	(98)	
Space heating												2878.9906	(98)	
Space heating per m2												(98) / (4) =	30.6276	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3181.2051 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	571.5679	443.4522	369.3424	213.2085	99.7861	0.0000	0.0000	0.0000	0.0000	200.4209	394.8629	586.3498	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	631.5667	490.0024	408.1132	235.5895	110.2609	0.0000	0.0000	0.0000	0.0000	221.4595	436.3126	647.9003	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	173.6276	152.2495	158.0417	139.0923	134.4337	117.4382	110.2441	124.4878	125.3770	144.3688	155.8872	168.5831	(64)
Efficiency of water heater (217)m	89.7336	89.6600	89.5167	89.2090	88.6352	87.3000	87.3000	87.3000	87.3000	89.1320	89.5707	87.3000	(216)
Fuel for water heating, kWh/month	193.4923	169.8076	176.5500	155.9174	151.6707	134.5226	126.2819	142.5977	143.6163	161.9719	174.0382	187.8045	(219)
Water heating fuel used												1918.2710	(219)
Annual totals kWh/year													
Space heating fuel - main system												3181.2051	(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)												413.7723	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1029 * 1.00) =										-1218.5571		-1218.5571	(233)
Total delivered energy for all uses												4369.6913	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3181.2051	3.4800	110.7059 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1918.2710	3.4800	66.7558 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	413.7723	13.1900	54.5766 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1218.5571	13.1900	-160.7277 (252)
Total energy cost			201.2032 (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] =	0.6080	(257)
SAP value		91.5191	
SAP rating (Section 12)		92	(258)
SAP band		A	

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	3181.2051	0.2160	687.1403 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1918.2710	0.2160	414.3465 (264)
Space and water heating			1101.4868 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	413.7723	0.5190	214.7478 (268)
Energy saving/generation technologies			
PV Unit	-1218.5571	0.5190	-632.4311 (269)
Total kg/year			722.7286 (272)
CO2 emissions per m2			7.6900 (273)
EI value			93.0327
EI rating			93
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8870 = 3.923$, stars = 4
Water heating environmental impact	$0.216 / 0.8870 = 0.2435$, 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	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 242.9900 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.3715 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3436 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3608	0.3350	0.3436	0.3264	0.3264	0.3178	0.3092	0.3007	0.2921	0.3178	0.3007	0.3178 (22b)
	0.5651	0.5561	0.5590	0.5533	0.5533	0.5505	0.5478	0.5452	0.5427	0.5505	0.5452	0.5505 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13531.9470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 143.9569 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7214 (36)
Total fabric heat loss (33) + (36) = 60.4807 (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	45.3121	44.5932	44.8269	44.3654	44.3654	44.1435	43.9275	43.7175	43.5133	44.1435	43.7175	44.1435 (38)
Heat transfer coeff	105.7927	105.0738	105.3075	104.8460	104.8460	104.6241	104.4082	104.1981	103.9940	104.6241	104.1981	104.6241 (39)
Average = Sum(39)m / 12 =												104.7114 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1255	1.1178	1.1203	1.1154	1.1154	1.1130	1.1107	1.1085	1.1063	1.1130	1.1085	1.1130 (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												2.6766 (42)
Average daily hot water use (litres/day)												97.7695 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	Total = Sum(45)m = 1538.2950 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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)
Combi loss	14.1393	12.7601	14.1011	13.6014	14.0221	13.5322	13.9599	14.0003	13.5699	14.0684	13.6542 (61)
Total heat required for water heating calculated for each month											
173.6276	152.2495	158.0417	139.0923	134.4337	117.4382	110.2441	124.4878	125.3770	144.3688	155.8872	168.5831 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
173.6276	152.2495	158.0417	139.0923	134.4337	117.4382	110.2441	124.4878	125.3770	144.3688	155.8872	168.5831 (64)
Heat gains from water heating, kWh/month											
56.5647	49.5703	51.3855	45.1261	43.5424	37.9318	35.5045	40.2372	40.5683	46.8420	50.7060	54.8884 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5738	52.0247	42.3093	32.0309	23.9435	20.2141	21.8420	28.3911	38.1065	48.3849	56.4723	60.2017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	367.5334	371.3472	361.7365	341.2763	315.4490	291.1749	274.9584	271.1445	280.7553	301.2155	327.0428	351.3169	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	(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)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	76.0278	73.7653	69.0666	62.6751	58.5247	52.6831	47.7211	54.0822	56.3449	62.9597	70.4250	73.7747	(72)
Total internal gains	612.4034	607.4057	583.3809	546.2508	508.1856	474.3406	454.7899	463.8863	485.4752	522.8285	564.2087	595.5618	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					4.1200	14.6176	0.4600	0.0000	0.7700		21.3316 (75)	
Southeast					1.5400	45.1778	0.4600	0.0000	0.7700		24.6431 (77)	
Southwest					4.4900	45.1778	0.4600	0.0000	0.7700		71.8489 (79)	
Southwest					3.3300	45.1778	0.4600	0.0000	0.7700		53.2866 (79)	
Solar gains	171.1102	254.2677	367.8458	488.1156	545.3413	600.2941	569.1876	514.3050	431.0642	308.0873	205.5918	143.1222 (83)
Total gains	783.5136	861.6734	951.2267	1034.3663	1053.5269	1074.6346	1023.9775	978.1913	916.5394	830.9158	769.8005	738.6839 (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	35.5306	35.7736	35.6943	35.8514	35.8514	35.9274	36.0017	36.0743	36.1451	35.9274	36.0743	35.9274
alpha	3.3687	3.3849	3.3796	3.3901	3.3901	3.3952	3.4001	3.4050	3.4097	3.3952	3.4050	3.3952
util living area	0.9591	0.9437	0.9054	0.8274	0.7039	0.5188	0.3871	0.4030	0.6308	0.8395	0.9326	0.9643 (86)
MIT	19.5597	19.7315	20.0710	20.4691	20.7729	20.9410	20.9835	20.9815	20.8829	20.5341	20.0161	19.5396 (87)
Th 2	19.9801	19.9863	19.9843	19.9883	19.9883	19.9902	19.9921	19.9939	19.9957	19.9902	19.9939	19.9902 (88)
util rest of house	0.9514	0.9334	0.8878	0.7952	0.6486	0.4387	0.2916	0.3044	0.5536	0.8018	0.9180	0.9574 (89)
MIT 2	18.0963	18.3451	18.8238	19.3724	19.7620	19.9474	19.9846	19.9854	19.8992	19.4730	18.7613	18.0750 (90)
Living area fraction									fLA = Living area / (4) =			0.1809 (91)
MIT	18.3610	18.5959	19.0494	19.5708	19.9448	20.1271	20.1652	20.1655	20.0771	19.6649	18.9883	18.3398 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2110	18.4459	18.8994	19.4208	19.7948	19.9771	20.0152	20.0155	19.9271	19.5149	18.8383	18.1898 (93)

8. Space heating requirement

Utilisation	0.9333	0.9128	0.8646	0.7744	0.6370	0.4376	0.2939	0.3065	0.5479	0.7807	0.8963	0.9405	(94)
Useful gains	731.2494	786.5695	822.4319	800.9755	671.0751	470.2988	300.9018	299.8644	502.1999	648.7198	689.9494	694.7360	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1408.2039	1381.2862	1253.0940	1040.1529	764.8326	489.3387	304.3759	303.7946	543.5893	849.0182	1139.7458	1379.9767	(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	503.6542	399.6496	320.4126	172.2077	69.7556	0.0000	0.0000	0.0000	0.0000	149.0221	323.8534	509.8191	(98)
Space heating												2448.3742	(98)
Space heating per m2												(98) / (4) =	26.0465 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2705.3859 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	503.6542	399.6496	320.4126	172.2077	69.7556	0.0000	0.0000	0.0000	0.0000	149.0221	323.8534	509.8191	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	556.5240	441.6018	354.0470	190.2847	77.0780	0.0000	0.0000	0.0000	0.0000	164.6653	357.8490	563.3361	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	173.6276	152.2495	158.0417	139.0923	134.4337	117.4382	110.2441	124.4878	125.3770	144.3688	155.8872	168.5831	(64)
Efficiency of water heater (217)m	89.6575	89.5940	89.4173	89.0417	88.3674	87.3000	87.3000	87.3000	87.3000	88.8966	89.4348	87.3000	(216)
Fuel for water heating, kWh/month	193.6566	169.9327	176.7461	156.2103	152.1304	134.5226	126.2819	142.5977	143.6163	162.4009	174.3027	187.9765	(219)
Water heating fuel used												1920.3746	(219)
Annual totals kWh/year													
Space heating fuel - main system												2705.3859	(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)												413.7723	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1156 * 1.00) =										-1368.9771		-1368.9771	(233)
Total delivered energy for all uses												3745.5557	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2705.3859	10.2300	276.7610 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1920.3746	10.2300	196.4543 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	413.7723	36.7200	151.9372 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-1368.9771	36.7200	-502.6884 (252)
Total energy cost			253.0041 (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	2705.3859	0.2160	584.3634 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1920.3746	0.2160	414.8009 (264)
Space and water heating			999.1643 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	413.7723	0.5190	214.7478 (268)
Energy saving/generation technologies			
PV Unit	-1368.9771	0.5190	-710.4991 (269)
Total kg/year			542.3380 (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	2705.3859	1.2200	3300.5708 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1920.3746	1.2200	2342.8570 (264)
Space and water heating			5643.4278 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	413.7723	3.0700	1270.2811 (268)
Energy saving/generation technologies			
PV Unit	-1368.9771	3.0700	-4202.7598 (269)
Primary energy kWh/year			2941.1991 (272)
Primary energy kWh/m2/year			31.2894 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 92
Current environmental impact rating: A 93

(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	+ 1.2	-£ 85	-191 kg (35.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£85 2.04 kg/m²	A 93	A 95
Total Savings	£85 2.04 kg/m²		
Potential energy efficiency rating:		A 93	
Potential environmental impact rating:			A 95

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£179	£198	-£18
Mains gas	£576	£473	£103
Space heating	£407	£407	£0
Water heating	£196	£112	£85
Lighting	£152	£152	£0
Generated (PV)	-£503	-£503	£0
Total cost of fuels	£252	£168	£85
Total cost of uses	£252	£168	£85
Delivered energy	40 kWh/m²	30 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	6 kg/m²	4 kg/m²	2 kg/m²
Primary energy	31 kWh/m²	20 kWh/m²	11 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	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.9900 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.3715 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3436 (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	0.4381	0.4295	0.4209	0.3780	0.3694	0.3264	0.3264	0.3178	0.3436	0.3694	0.3866	0.4037 (22b)
Effective ac	0.5960	0.5922	0.5886	0.5714	0.5682	0.5533	0.5533	0.5505	0.5590	0.5682	0.5747	0.5815 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (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) = 13531.9470 (34)
143.9569 (35)
6.7214 (36)
(33) + (36) = 60.4807 (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	47.7883	47.4895	47.1966	45.8209	45.5635	44.3654	44.3654	44.1435	44.8269	45.5635	46.0842	46.6286 (38)
Heat transfer coeff	108.2690	107.9702	107.6773	106.3016	106.0442	104.8460	104.8460	104.6241	105.3075	106.0442	106.5649	107.1092 (39)
Average = Sum(39)m / 12 =												106.3004 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1518	1.1486	1.1455	1.1309	1.1281	1.1154	1.1154	1.1130	1.1203	1.1281	1.1337	1.1395 (40)
HLP (average)												1.1309 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.6766 (42)
97.7695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum (45)m =	1538.2950 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684	(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)
Combi loss	14.1393	12.7601	14.1011	13.6014	14.0221	13.5322	13.9599	14.0003	13.5699	14.0684	13.6542	14.1273	(61)
Total heat required for water heating calculated for each month													
	173.6276	152.2495	158.0417	139.0923	134.4337	117.4382	110.2441	124.4878	125.3770	144.3688	155.8872	168.5831	(62)
Aperture area of solar collector													
Zero-loss collector efficiency													
Collector heat loss coefficient													
Collector 2nd order heat loss coefficient													
Collector effective heat loss coefficient													
Collector performance ratio													
Annual solar radiation per m2													
Overshading factor													
Solar energy available													
Adjustment factor for showers													
Solar-to-load ratio													
Utilisation factor													
Collector performance factor													
Dedicated solar storage volume													
Effective solar volume													
Daily hot water demand													
Volume ratio Veff/V													
Solar storage volume factor													
Solar input													
Solar input	-25.0402	-41.7849	-71.1644	-95.3744	-117.8270	-115.8427	-114.3118	-99.8748	-78.2220	-53.4164	-29.7013	-863.5142	(63)
Output from w/h													
	148.5874	110.4646	86.8773	43.7179	16.6067	1.5955	0.0000	24.6130	47.1550	90.9524	126.1859	147.6288	(64)
Heat gains from water heating, kWh/month													
	56.5647	49.5703	51.3855	45.1261	43.5424	37.9318	35.5045	40.2372	40.5683	46.8420	50.7060	54.8884	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5738	52.0247	42.3093	32.0309	23.9435	20.2141	21.8420	28.3911	38.1065	48.3849	56.4723	60.2017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	367.5334	371.3472	361.7365	341.2763	315.4490	291.1749	274.9584	271.1445	280.7553	301.2155	327.0428	351.3169	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	(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)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	76.0278	73.7653	69.0666	62.6751	58.5247	52.6831	47.7211	54.0822	56.3449	62.9597	70.4250	73.7747	(72)
Total internal gains	612.4034	607.4057	583.3809	546.2508	508.1856	474.3406	454.7899	463.8863	485.4752	522.8285	564.2087	595.5618	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				4.1200	11.2829	0.4600		0.0000		0.7700		16.4652 (75)	
Southeast				1.5400	36.7938	0.4600		0.0000		0.7700		20.0699 (77)	
Southwest				4.4900	36.7938	0.4600		0.0000		0.7700		58.5154 (79)	
Southwest				3.3300	36.7938	0.4600		0.0000		0.7700		43.3978 (79)	

Solar gains	138.4483	241.2977	344.6809	451.4257	527.8592	533.8180	510.5892	452.0718	381.4123	270.6022	166.8251	117.8384 (83)	
Total gains	750.8517	848.7034	928.0618	997.6764	1036.0449	1008.1586	965.3792	915.9581	866.8875	793.4307	731.0338	713.4002 (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	34.7179	34.8140	34.9087	35.3605	35.4463	35.8514	35.8514	35.9274	35.6943	35.4463	35.2731	35.0938	
alpha	3.3145	3.3209	3.3272	3.3574	3.3631	3.3901	3.3901	3.3952	3.3796	3.3631	3.3515	3.3396	
util living area	0.9675	0.9504	0.9197	0.8572	0.7515	0.5983	0.4566	0.4956	0.6995	0.8784	0.9502	0.9720	(86)
MIT	19.3749	19.5990	19.9348	20.3486	20.6860	20.8971	20.9689	20.9585	20.8177	20.3862	19.8123	19.3327	(87)
Th 2	19.9588	19.9613	19.9638	19.9757	19.9779	19.9883	19.9883	19.9902	19.9843	19.9779	19.9734	19.9687	(88)
util rest of house	0.9614	0.9413	0.9046	0.8297	0.7033	0.5228	0.3600	0.3981	0.6297	0.8491	0.9394	0.9667	(89)
MIT 2	17.8166	18.1393	18.6187	19.2020	19.6475	19.9042	19.9712	19.9658	19.8205	19.2674	18.4584	17.7623	(90)
Living area fraction													
MIT	18.0984	18.4033	18.8567	19.4094	19.8353	20.0838	20.1517	20.1454	20.0009	19.4697	18.7032	18.0463	(92)
Temperature adjustment													
adjusted MIT	17.9484	18.2533	18.7067	19.2594	19.6853	19.9338	20.0017	19.9954	19.8509	19.3197	18.5532	17.8963	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9449	0.9212	0.8814	0.8070	0.6879	0.5185	0.3614	0.3986	0.6195	0.8259	0.9194	0.9516	(94)
Useful gains	709.4626	781.8575	817.9549	805.0982	712.6780	522.7025	348.8630	365.1393	537.0471	655.2953	672.0891	678.8960	(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	1477.6990	1441.7565	1314.3829	1101.2211	846.7991	559.2226	356.6510	376.1616	605.6110	924.6782	1220.5099	1467.0006	(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	571.5679	443.4522	369.3424	213.2085	99.7861	0.0000	0.0000	0.0000	0.0000	200.4209	394.8629	586.3498	(98)
Space heating												2878.9906	(98)
Space heating per m2												30.6276	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3181.2051 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	571.5679	443.4522	369.3424	213.2085	99.7861	0.0000	0.0000	0.0000	0.0000	200.4209	394.8629	586.3498	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	631.5667	490.0024	408.1132	235.5895	110.2609	0.0000	0.0000	0.0000	0.0000	221.4595	436.3126	647.9003	(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	148.5874	110.4646	86.8773	43.7179	16.6067	1.5955	0.0000	24.6130	47.1550	90.9524	126.1859	147.6288	(64)
Efficiency of water heater	89.8207	89.8433	89.8727	89.9390	90.0292	87.3000	87.3000	87.3000	87.3000	89.4762	89.7037	87.3000	(216)
(217)m	89.8207	89.8433	89.8727	89.9390	90.0292	87.3000	87.3000	87.3000	87.3000	89.4762	89.7037	89.8377	(217)
Fuel for water heating, kWh/month	165.4267	122.9526	96.6671	48.6084	18.4459	1.8276	0.0000	28.1936	54.0149	101.6498	140.6697	164.3284	(219)
Water heating fuel used												942.7848	(219)
Annual totals kWh/year													
Space heating fuel - main system												3181.2051	(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)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												413.7723	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1029 * 1.00) =										-1218.5571		-1218.5571	(233)
Total delivered energy for all uses												3444.2052	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3181.2051	3.4800	110.7059	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	942.7848	3.4800	32.8089	(247)
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	413.7723	13.1900	54.5766	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1218.5571	13.1900	-160.7277	(252)
Total energy cost			173.8512	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)			0.5253 (257)
SAP value			92.6720
SAP rating (Section 12)			93 (258)
SAP band			A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3181.2051	0.2160	687.1403	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.7848	0.2160	203.6415	(264)
Space and water heating			890.7818	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	413.7723	0.5190	214.7478	(268)
Energy saving/generation technologies				
PV Unit	-1218.5571	0.5190	-632.4311	(269)
Total kg/year			537.9735	(272)
CO2 emissions per m2			5.7200	(273)
EI value			94.8138	
EI rating			95	(274)
EI band			A	

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	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 242.9900 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.3715 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3436 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3608	0.3350	0.3436	0.3264	0.3264	0.3178	0.3092	0.3007	0.2921	0.3178	0.3007	0.3178 (22b)
	0.5651	0.5561	0.5590	0.5533	0.5533	0.5505	0.5478	0.5452	0.5427	0.5505	0.5452	0.5505 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13531.9470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							143.9569 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7214 (36)
Total fabric heat loss							(33) + (36) = 60.4807 (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	45.3121	44.5932	44.8269	44.3654	44.3654	44.1435	43.9275	43.7175	43.5133	44.1435	43.7175	44.1435 (38)
Heat transfer coeff	105.7927	105.0738	105.3075	104.8460	104.8460	104.6241	104.4082	104.1981	103.9940	104.6241	104.1981	104.6241 (39)
Average = Sum(39)m / 12 =												104.7114 (39)
HLP	1.1255	1.1178	1.1203	1.1154	1.1154	1.1130	1.1107	1.1085	1.1063	1.1130	1.1085	1.1130 (40)
HLP (average)												1.1140 (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												2.6766 (42)
Average daily hot water use (litres/day)												97.7695 (43)
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

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 content (annual)	Total = Sum (45)m = 1538.2950 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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)
Combi loss	14.1393	12.7601	14.1011	13.6014	14.0221	13.5322	13.9599	14.0003	13.5699	14.0684	13.6542 (61)
Total heat required for water heating calculated for each month											
173.6276	152.2495	158.0417	139.0923	134.4337	117.4382	110.2441	124.4878	125.3770	144.3688	155.8872	168.5831 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1208.1510 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											2029.6937 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.3194 (H8)
Collector performance factor											0.5313 (H9)
Dedicated solar storage volume											0.8793 (H10)
Effective solar volume											75.0000 (H11)
Daily hot water demand											75.0000 (H13)
Volume ratio Veff/V											97.7695 (H14)
Solar storage volume factor											0.7671 (H15)
Solar input											0.9470 (H16)
Solar input	-29.2953	-41.6561	-71.5968	-96.6006	-113.4633	-121.1967	-118.6479	-106.1935	-83.1422	-57.4816	-34.6486 (63)
Output from w/h											
144.3323	110.5935	86.4449	42.4917	20.9704	0.0000	0.0000	18.2943	42.2348	86.8872	121.2386	144.4939 (64)
Heat gains from water heating, kWh/month											
56.5647	49.5703	51.3855	45.1261	43.5424	37.9318	35.5045	40.2372	40.5683	46.8420	50.7060	54.8884 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5738	52.0247	42.3093	32.0309	23.9435	20.2141	21.8420	28.3911	38.1065	48.3849	56.4723	60.2017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	367.5334	371.3472	361.7365	341.2763	315.4490	291.1749	274.9584	271.1445	280.7553	301.2155	327.0428	351.3169	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	(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)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	76.0278	73.7653	69.0666	62.6751	58.5247	52.6831	47.7211	54.0822	56.3449	62.9597	70.4250	73.7747	(72)
Total internal gains	612.4034	607.4057	583.3809	546.2508	508.1856	474.3406	454.7899	463.8863	485.4752	522.8285	564.2087	595.5618	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		Specific data or Table 6c	FF	Access factor Table 6d		Gains W
Northeast				4.1200	14.6176	0.4600			0.0000	0.7700		21.3316 (75)
Southeast				1.5400	45.1778	0.4600			0.0000	0.7700		24.6431 (77)
Southwest				4.4900	45.1778	0.4600			0.0000	0.7700		71.8489 (79)
Southwest				3.3300	45.1778	0.4600			0.0000	0.7700		53.2866 (79)

Solar gains	171.1102	254.2677	367.8458	488.1156	545.3413	600.2941	569.1876	514.3050	431.0642	308.0873	205.5918	143.1222 (83)
Total gains	783.5136	861.6734	951.2267	1034.3663	1053.5269	1074.6346	1023.9775	978.1913	916.5394	830.9158	769.8005	738.6839 (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	35.5306	35.7736	35.6943	35.8514	35.8514	35.9274	36.0017	36.0743	36.1451	35.9274	36.0743	35.9274
alpha	3.3687	3.3849	3.3796	3.3901	3.3901	3.3952	3.4001	3.4050	3.4097	3.3952	3.4050	3.3952
util living area	0.9591	0.9437	0.9054	0.8274	0.7039	0.5188	0.3871	0.4030	0.6308	0.8395	0.9326	0.9643 (86)
MIT	19.5597	19.7315	20.0710	20.4691	20.7729	20.9410	20.9835	20.9815	20.8829	20.5341	20.0161	19.5396 (87)
Th 2	19.9801	19.9863	19.9843	19.9883	19.9883	19.9902	19.9921	19.9939	19.9957	19.9902	19.9939	19.9902 (88)
util rest of house	0.9514	0.9334	0.8878	0.7952	0.6486	0.4387	0.2916	0.3044	0.5536	0.8018	0.9180	0.9574 (89)
MIT 2	18.0963	18.3451	18.8238	19.3724	19.7620	19.9474	19.9846	19.9854	19.8992	19.4730	18.7613	18.0750 (90)
Living area fraction												0.1809 (91)
MIT	18.3610	18.5959	19.0494	19.5708	19.9448	20.1271	20.1652	20.1655	20.0771	19.6649	18.9883	18.3398 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2110	18.4459	18.8994	19.4208	19.7948	19.9771	20.0152	20.0155	19.9271	19.5149	18.8383	18.1898 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9333	0.9128	0.8646	0.7744	0.6370	0.4376	0.2939	0.3065	0.5479	0.7807	0.8963	0.9405	(94)
Useful gains	731.2494	786.5695	822.4319	800.9755	671.0751	470.2988	300.9018	299.8644	502.1999	648.7198	689.9494	694.7360	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1408.2039	1381.2862	1253.0940	1040.1529	764.8326	489.3387	304.3759	303.7946	543.5893	849.0182	1139.7458	1379.9767	(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	503.6542	399.6496	320.4126	172.2077	69.7556	0.0000	0.0000	0.0000	0.0000	149.0221	323.8534	509.8191	(98)
Space heating												2448.3742	(98)
Space heating per m2											(98) / (4) =	26.0465	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2705.3859	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	503.6542	399.6496	320.4126	172.2077	69.7556	0.0000	0.0000	0.0000	0.0000	149.0221	323.8534	509.8191	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	556.5240	441.6018	354.0470	190.2847	77.0780	0.0000	0.0000	0.0000	0.0000	164.6653	357.8490	563.3361	(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	144.3323	110.5935	86.4449	42.4917	20.9704	0.0000	0.0000	18.2943	42.2348	86.8872	121.2386	144.4939	(64)	
Efficiency of water heater	89.7671	89.7867	89.8006	89.8482	89.7397	87.3000	87.3000	87.3000	87.3000	89.2945	89.6053	87.3000	(216)	
Fuel for water heating, kWh/month	160.7853	123.1736	96.2632	47.2927	23.3681	0.0000	0.0000	20.9557	48.3790	97.3041	135.3029	160.9541	(219)	
Water heating fuel used												913.7786	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2705.3859	(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)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													413.7723	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.48 * 1156 * 1.00) =										-1368.9771		-1368.9771	(233)	
Total delivered energy for all uses												2788.9597	(238)	

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2705.3859	10.2300	276.7610	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	913.7786	10.2300	93.4795	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	413.7723	36.7200	151.9372	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-1368.9771	36.7200	-502.6884	(252)
Total energy cost			168.3893	(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	2705.3859	0.2160	584.3634	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	913.7786	0.2160	197.3762	(264)
Space and water heating			781.7395	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	413.7723	0.5190	214.7478	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

PV Unit	-1368.9771	0.5190	-710.4991 (269)
Total kg/year			350.8632 (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	2705.3859	1.2200	3300.5708 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	913.7786	1.2200	1114.8098 (264)
Space and water heating			4415.3807 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	413.7723	3.0700	1270.2811 (268)
Energy saving/generation technologies			
PV Unit	-1368.9771	3.0700	-4202.7598 (269)
Primary energy kWh/year			1866.6519 (272)
Primary energy kWh/m2/year			19.8580 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	144.0 (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	320.75 (P1)
Transmission heat loss coefficient	60.48 (37)
Summer heat loss coefficient	381.23 (P2)

Overhangs

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

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	4.1200	106.0502	0.4600	0.0000	0.9000	180.8877
South East	1.5400	127.3119	0.4600	0.0000	0.9000	81.1689
South West	4.4900	127.3119	0.4600	0.0000	0.9000	236.6549
South West	3.3300	127.3119	0.4600	0.0000	0.9000	175.5147

total:						674.2263
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	Jun	Jul	Aug	
Solar gains	723	674	607	(P4)
Internal gains	471	452	461	
Total summer gains	1194	1126	1068	(P5)

	3.13	2.95	2.80	
Summer gain/loss ratio	3.13	2.95	2.80	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 144.0)	0.99	0.99	0.99	
Threshold temperature	19.52	21.25	21.09	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature:	Slight
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