

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-154			Issued on Date	11/11/2022
Assessment Reference	As Built	Prop Type Ref	Dv1 Semi Op		
Property	1, Keepers Drive, Fair Oak, EASTLEIGH, SO50 7QR				
SAP Rating	88 B	DER	12.12	TER	16.56
Environmental	90 B	% DER<TER	26.80		
CO ₂ Emissions (t/year)	1.03	DFEE	42.25	TFEE	49.63
General Requirements Compliance	Pass	% DFEE<TFEE	14.87		
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk			Assessor ID	T510-0001
Client	Drew Smith				

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 108 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.56 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.12 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.39 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.65 (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

Continuous extract system (decentralised)
Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 5.49 m², No overhang
Windows facing South: 8.06 m², No overhang
Windows facing West: 1.80 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.60 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	54.0000 (1b)	x 2.4000 (2b)	= 129.6000 (1b) - (3b)
First floor	54.0000 (1c)	x 2.6800 (2c)	= 144.7200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.3200 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.6500
Infiltration rate												0.2325 (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) =	0.2151 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2742	0.2688	0.2635	0.2366	0.2312	0.2043	0.2043	0.1989	0.2151	0.2312	0.2419	0.2527 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5242	0.5188	0.5135	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5027 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			11.5500	1.3258	15.3125		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			54.0000	0.1700	9.1800	75.0000	4050.0000 (28a)					
140mm Timber Frame	106.1700	17.4700	88.7000	0.1900	16.8530	9.0000	798.3000 (29a)					
400mm Mineral Wool	54.0000		54.0000	0.1100	5.9400	9.0000	486.0000 (30)					
Total net area of external elements Aum(A, m2)			214.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.0794		(33)					
Timebr Frame			47.3500	0.0000	0.0000	20.0000	947.0000 (32)					
Timber GF			68.3000			9.0000	614.7000 (32c)					
Timber FF			118.9400			9.0000	1070.4600 (32c)					
Internal Floor			54.0000			18.0000	972.0000 (32d)					
Internal Ceiling			54.0000			18.0000	972.0000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9910.4600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							91.7635 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.8394 (36)					
Total fabric heat loss						(33) + (36) =	67.9188 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.4539	Feb 46.9672	Mar 46.4805	Apr 45.2628	May 45.2628	Jun 45.2628	Jul 45.2628	Aug 45.2628	Sep 45.2628	Oct 45.2628	Nov 45.2628	Dec 45.5071 (38)
Heat transfer coeff	115.3727	114.8860	114.3993	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.4259 (39)
Average = Sum(39)m / 12 =												113.6281 (39)
HLP	Jan 1.0683	Feb 1.0638	Mar 1.0593	Apr 1.0480	May 1.0480	Jun 1.0480	Jul 1.0480	Aug 1.0480	Sep 1.0480	Oct 1.0480	Nov 1.0480	Dec 1.0502 (40)
HLP (average)												1.0521 (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												2.8023 (42)
Average daily hot water use (litres/day)												100.7540 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Daily hot water use	110.8294	106.7992	102.7691	98.7389	94.7087	90.6786	90.6786	94.7087	98.7389	102.7691	106.7992	110.8294 (44)
Energy conte	164.3568	143.7475	148.3345	129.3216	124.0872	107.0778	99.2233	113.8602	115.2201	134.2779	146.5748	159.1708 (45)
Energy content (annual)										Total = Sum (45)m =		1585.2524 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6535	21.5621	22.2502	19.3982	18.6131	16.0617	14.8835	17.0790	17.2830	20.1417	21.9862	23.8756 (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	14.1510	12.7703	14.1126	13.6193	14.0386	13.5458	13.9725	14.0154	13.5858	14.0788	13.6646	14.1386 (61)
Total heat required for water heating calculated for each month	178.5078	156.5178	162.4471	142.9409	138.1258	120.6236	113.1958	127.8756	128.8059	148.3567	160.2394	173.3093 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	178.5078	156.5178	162.4471	142.9409	138.1258	120.6236	113.1958	127.8756	128.8059	148.3567	160.2394	173.3093 (64)
Heat gains from water heating, kWh/month	58.1864	50.9886	52.8494	46.4043	44.7686	38.9898	36.4849	41.3624	41.7071	48.1671	52.1523	56.4589 (65)
										Total per year (kWh/year) = Sum (64)m =		1750.9457 (64)

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	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6104	22.7469	18.4990	14.0050	10.4689	8.8383	9.5500	12.4135	16.6614	21.1555	24.6916	26.3222 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	268.6506	271.4384	264.4133	249.4578	230.5792	212.8360	200.9824	198.1946	205.2197	220.1752	239.0538	256.7970 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114 (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)	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909 (71)
Water heating gains (Table 5)	78.2075	75.8759	71.0341	64.4504	60.1729	54.1525	49.0388	55.5946	57.9266	64.7407	72.4337	75.8856 (72)
Total internal gains	440.5026	438.0953	421.9805	395.9472	369.2551	343.8609	327.6053	334.2368	347.8417	374.1055	404.2132	427.0389 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	5.4900	10.6334	0.7200	0.7000	0.7700	20.3896 (74)
South	4.2600	46.7521	0.7200	0.7000	0.7700	69.5623 (78)
West	1.8000	19.6403	0.7200	0.7000	0.7700	12.3476 (80)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509 (78)

Solar gains	164.3504	278.6687	380.5617	474.6933	537.7451	537.3626	516.5535	468.4188	412.6945	307.5342	196.5558	140.8778 (83)
Total gains	604.8530	716.7639	802.5423	870.6405	907.0002	881.2235	844.1588	802.6556	760.5362	681.6396	600.7689	567.9167 (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	23.8610	23.9621	24.0640	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.2705
alpha	2.5907	2.5975	2.6043	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6180
util living area	0.9654	0.9460	0.9159	0.8622	0.7753	0.6498	0.5188	0.5561	0.7334	0.8834	0.9489	0.9701 (86)
MIT	18.5911	18.8947	19.3373	19.8813	20.3685	20.7257	20.8914	20.8657	20.5966	19.9606	19.1866	18.5534 (87)
Th 2	20.0268	20.0305	20.0342	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0417 (88)
util rest of house	0.9605	0.9386	0.9040	0.8413	0.7383	0.5858	0.4268	0.4659	0.6781	0.8614	0.9406	0.9659 (89)
MIT 2	16.7859	17.2262	17.8650	18.6436	19.3163	19.7792	19.9656	19.9418	19.6280	18.7683	17.6610	16.7395 (90)
Living area fraction	17.0701	17.4888	18.0968	18.8384	19.4819	19.9282	20.1113	20.0872	19.7804	18.9560	17.9012	17.0250 (91)
MIT	17.0701	17.4888	18.0968	18.8384	19.4819	19.9282	20.1113	20.0872	19.7804	18.9560	17.9012	17.0250 (92)
Temperature adjustment	16.9201	17.3388	17.9468	18.6884	19.3319	19.7782	19.9613	19.9372	19.6304	18.8060	17.7512	-0.1500
adjusted MIT	16.9201	17.3388	17.9468	18.6884	19.3319	19.7782	19.9613	19.9372	19.6304	18.8060	17.7512	16.8750 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9373	0.9094	0.8695	0.8044	0.7060	0.5660	0.4182	0.4549	0.6503	0.8245	0.9121	0.9449 (94)
Ext temp.	566.9190	651.8274	697.7965	700.3732	640.3261	498.7558	353.0441	365.1115	494.5750	562.0177	547.9813	536.6332 (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	1456.0129	1429.0454	1309.5040	1107.8711	863.7897	586.0721	380.4357	400.3475	625.9448	928.7656	1205.5153	1437.6757 (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	661.4858	522.2905	455.1103	293.3985	166.2569	0.0000	0.0000	0.0000	0.0000	272.8604	473.4245	670.3756 (98)
Space heating per m2												3515.2025 (98)
										(98) / (4) =		32.5482 (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	3884.2017 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	661.4858	522.2905	455.1103	293.3985	166.2569	0.0000	0.0000	0.0000	0.0000	272.8604	473.4245	670.3756 (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)	730.9236	577.1166	502.8843	324.1972	183.7093	0.0000	0.0000	0.0000	0.0000	301.5032	523.1210	740.7465 (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	178.5078	156.5178	162.4471	142.9409	138.1258	120.6236	113.1958	127.8756	128.8059	148.3567	160.2394	173.3093 (64)
Efficiency of water heater (217)m	89.8005	89.7415	89.6357	89.4262	89.0193	87.3000	87.3000	87.3000	87.3000	89.3465	89.6688	87.3000 (216)
Fuel for water heating, kWh/month	198.7826	174.4095	181.2303	159.8423	155.1639	138.1714	129.6630	146.4783	147.5440	166.0465	178.7013	192.9440 (219)
Water heating fuel used												1968.9772 (219)
Annual totals kWh/year												
Space heating fuel - main system												3884.2017 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												76.7842 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												151.7842 (231)
Electricity for lighting (calculated in Appendix L)												452.2872 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.60 * 1080 * 1.00) =												-518.1718
Total delivered energy for all uses												5939.0785 (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	3884.2017	0.2160	838.9876 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1968.9772	0.2160	425.2991 (264)
Space and water heating			1264.2866 (265)
Pumps and fans	151.7842	0.5190	78.7760 (267)
Energy for lighting	452.2872	0.5190	234.7370 (268)
Energy saving/generation technologies			
PV Unit	-518.1718	0.5190	-268.9312 (269)
Total CO2, kg/year			1308.8685 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.1200 (273)

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

DER	12.1200	ZC1
Total Floor Area	108.0000	TFA
Assumed number of occupants	2.8023	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	14.7404	ZC2
CO2 emissions from cooking, equation (L16)	1.7246	ZC3
Total CO2 emissions	28.5850	ZC4
Residual CO2 emissions offset from biofuel CHP	0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	28.5850	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	54.0000 (1b)	x 2.4000 (2b)	= 129.6000 (1b) - (3b)
First floor	54.0000 (1c)	x 2.6800 (2c)	= 144.7200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.3200 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.1458 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.3958 (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) =					0.3661 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4668	0.4577	0.4485	0.4027	0.3936	0.3478	0.3478	0.3387	0.3661	0.3936	0.4119	0.4302	(22b)				
Effective ac	0.6090	0.6047	0.6006	0.5811	0.5775	0.5605	0.5605	0.5573	0.5670	0.5775	0.5848	0.5925	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			15.3500	1.3258	20.3504		(27)					
150mm EPS B&B			54.0000	0.1300	7.0200		(28a)					
140mm Timber Frame	106.1700	17.4700	88.7000	0.1800	15.9660		(29a)					
400mm Mineral Wool	54.0000		54.0000	0.1300	7.0200		(30)					
Total net area of external elements Aum(A, m2)			214.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		52.4764		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.5440 (36)					
Total fabric heat loss						(33) + (36) =	63.0204 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.1263	Feb 54.7433	Mar 54.3678	Apr 52.6045	May 52.2746	Jun 50.7387	Jul 50.7387	Aug 50.4543	Sep 51.3303	Oct 52.2746	Nov 52.9420	Dec 53.6397 (38)
Heat transfer coeff	118.1467	117.7636	117.3882	115.6249	115.2949	113.7591	113.7591	113.4747	114.3507	115.2949	115.9624	116.6601 (39)
Average = Sum(39)m / 12 =												115.6233 (39)
HLP	Jan 1.0940	Feb 1.0904	Mar 1.0869	Apr 1.0706	May 1.0675	Jun 1.0533	Jul 1.0533	Aug 1.0507	Sep 1.0588	Oct 1.0675	Nov 1.0737	Dec 1.0802 (40)
HLP (average)												1.0706 (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												2.8023 (42)
Average daily hot water use (litres/day)												100.7540 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.8294	106.7992	102.7691	98.7389	94.7087	90.6786	90.6786	94.7087	98.7389	102.7691	106.7992	110.8294 (44)
Energy conte	164.3568	143.7475	148.3345	129.3216	124.0872	107.0778	99.2233	113.8602	115.2201	134.2779	146.5748	159.1708 (45)
Energy content (annual)											Total = Sum(45)m =	1585.2524 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	24.6535	21.5621	22.2502	19.3982	18.6131	16.0617	14.8835	17.0790	17.2830	20.1417	21.9862	23.8756 (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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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	50.9589	48.6932	48.2625	44.7182	46.2088	48.2625	48.6932	50.9589	49.3151	50.9589 (61)
Solar input	215.3157	189.7749	199.2934	178.0148	172.3497	151.7960	145.4321	162.1228	163.9132	185.2368	195.8899	210.1297 (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	215.3157	189.7749	199.2934	178.0148	172.3497	151.7960	145.4321	162.1228	163.9132	185.2368	195.8899	210.1297 (64)
	67.3884	59.3029	62.0610	55.1727	53.3246	46.7829	44.5440	49.9242	50.4840	57.3871	61.0649	65.6640 (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	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6104	22.7469	18.4990	14.0050	10.4689	8.8383	9.5500	12.4135	16.6614	21.1555	24.6916	26.3222	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	268.6506	271.4384	264.4133	249.4578	230.5792	212.8360	200.9824	198.1946	205.2197	220.1752	239.0538	256.7970	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	(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)	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	(71)
Water heating gains (Table 5)	90.5757	88.2483	83.4153	76.6288	71.6729	64.9763	59.8709	67.1024	70.1166	77.1332	84.8123	88.2581	(72)
Total internal gains	452.8708	450.4677	434.3617	408.1257	380.7550	354.6846	338.4374	345.7446	360.0318	386.4980	416.5918	439.4114	(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		
North					5.4900	10.6334	0.6300	0.7000	0.7700		17.8409 (74)		
South					8.0600	46.7521	0.6300	0.7000	0.7700		115.1616 (78)		
West					1.8000	19.6403	0.6300	0.7000	0.7700		10.8042 (80)		
Solar gains	143.8066	243.8351	332.9915	415.3566	470.5270	470.1923	451.9843	409.8664	361.1076	269.0924	171.9863	123.2681	(83)
Total gains	596.6775	694.3028	767.3532	823.4823	851.2820	824.8769	790.4217	755.6110	721.1394	655.5904	588.5781	562.6794	(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	63.4804	63.6869	63.8906	64.8649	65.0506	65.9288	65.9288	66.0940	65.5877	65.0506	64.6762	64.2893	
alpha	5.2320	5.2458	5.2594	5.3243	5.3367	5.3953	5.3953	5.4063	5.3725	5.3367	5.3117	5.2860	
util living area	0.9987	0.9967	0.9916	0.9746	0.9217	0.7866	0.6124	0.6589	0.8784	0.9815	0.9970	0.9990	(86)
MIT	19.7901	19.9416	20.1720	20.4737	20.7461	20.9299	20.9854	20.9787	20.8624	20.5095	20.0960	19.7689	(87)
Th 2	20.0058	20.0087	20.0115	20.0249	20.0274	20.0391	20.0391	20.0413	20.0346	20.0274	20.0223	20.0170	(88)
util rest of house	0.9982	0.9956	0.9885	0.9644	0.8882	0.7029	0.4893	0.5372	0.8164	0.9721	0.9957	0.9987	(89)
MIT 2	18.3845	18.6077	18.9453	19.3889	19.7636	19.9886	20.0333	20.0318	19.9182	19.4461	18.8439	18.3616	(90)
Living area fraction	18.6057	18.8177	19.1384	19.5596	19.9183	20.1368	20.1832	20.1809	20.0668	19.6135	19.0410	18.5831	(91)
MIT	18.6057	18.8177	19.1384	19.5596	19.9183	20.1368	20.1832	20.1809	20.0668	19.6135	19.0410	18.5831	(92)
Temperature adjustment	18.6057	18.8177	19.1384	19.5596	19.9183	20.1368	20.1832	20.1809	20.0668	19.6135	19.0410	18.5831	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9972	0.9936	0.9847	0.9580	0.8836	0.7123	0.5086	0.5560	0.8188	0.9666	0.9939	0.9979	(94)
Ext temp.	595.0125	689.8620	755.6059	788.8554	752.2011	587.5804	401.9949	420.0983	590.4958	633.7018	584.9656	561.5178	(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	1690.1721	1638.9988	1483.5981	1232.5203	947.5244	629.8580	407.6183	429.0310	682.3085	1039.2054	1384.7024	1677.9318	(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	814.7988	637.8199	541.6262	319.4387	145.3205	0.0000	0.0000	0.0000	0.0000	301.6947	575.8105	830.6120	(98)
Space heating per m2												4167.1212	(98)
												38.5845	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4461.5859 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	814.7988	637.8199	541.6262	319.4387	145.3205	0.0000	0.0000	0.0000	0.0000	301.6947	575.8105	830.6120 (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)	872.3756	682.8907	579.8995	342.0115	155.5894	0.0000	0.0000	0.0000	0.0000	323.0136	616.4994	889.3062 (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	215.3157	189.7749	199.2934	178.0148	172.3497	151.7960	145.4321	162.1228	163.9132	185.2368	195.8899	210.1297 (64)
Efficiency of water heater (217)m	88.0842	87.8658	87.4417	86.5063	84.6252	80.3000	80.3000	80.3000	80.3000	86.2720	87.6030	80.3000 (216)
Fuel for water heating, kWh/month	244.4429	215.9827	227.9158	205.7823	203.6625	189.0361	181.1110	201.8963	204.1261	214.7124	223.6109	238.3473 (219)
Water heating fuel used												2550.6264 (219)
Annual totals kWh/year												
Space heating fuel - main system												4461.5859 (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)												452.2872 (232)
Total delivered energy for all uses												7539.4994 (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	4461.5859	0.2160	963.7026 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2550.6264	0.2160	550.9353 (264)
Space and water heating			1514.6379 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	452.2872	0.5190	234.7370 (268)
Total CO2, kg/m2/year			1788.2999 (272)
Emissions per m2 for space and water heating			14.0244 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1735 (272b)
Emissions per m2 for pumps and fans			0.3604 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0244 * 1.00) + 2.1735 + 0.3604, rounded to 2 d.p.			16.5600 (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	54.0000 (1b)	x 2.4000 (2b)	= 129.6000 (1b) - (3b)
First floor	54.0000 (1c)	x 2.6800 (2c)	= 144.7200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.3200 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1458 (8)
Pressure test					Yes
Measured/design AP50					4.6500
Infiltration rate					0.3783 (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) =		0.3499 (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	0.4462	0.4374	0.4287	0.3849	0.3762	0.3324	0.3324	0.3237	0.3499	0.3762	0.3937	0.4112 (22b)
Effective ac	0.5995	0.5957	0.5919	0.5741	0.5708	0.5553	0.5553	0.5524	0.5612	0.5708	0.5775	0.5845 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			11.5500	1.3258	15.3125		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
150mm EPS B&B			54.0000	0.1700	9.1800	75.0000	4050.0000 (28a)
140mm Timber Frame	106.1700	17.4700	88.7000	0.1900	16.8530	9.0000	798.3000 (29a)
400mm Mineral Wool	54.0000		54.0000	0.1100	5.9400	9.0000	486.0000 (30)
Total net area of external elements Aum(A, m ²)			214.1700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.0794			(33)
Timebr Frame			47.3500	0.0000	0.0000	20.0000	947.0000 (32)
Timber GF			68.3000			9.0000	614.7000 (32c)
Timber FF			118.9400			9.0000	1070.4600 (32c)
Internal Floor			54.0000			18.0000	972.0000 (32d)
Internal Ceiling			54.0000			9.0000	486.0000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9424.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							87.2635 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.8394 (36)
Total fabric heat loss					(33) + (36) =		67.9188 (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	54.2734	53.9235	53.5805	51.9696	51.6682	50.2652	50.2652	50.0054	50.8056	51.6682	52.2780	52.9154 (38)
Heat transfer coeff	122.1922	121.8423	121.4993	119.8884	119.5870	118.1840	118.1840	117.9242	118.7244	119.5870	120.1968	120.8342 (39)
Average = Sum(39)m / 12 =												119.8870 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1314	1.1282	1.1250	1.1101	1.1073	1.0943	1.0943	1.0919	1.0993	1.1073	1.1129	1.1188 (40)
HLP (average)												1.1101 (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												2.8023 (42)
Average daily hot water use (litres/day)												100.7540 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.8294	106.7992	102.7691	98.7389	94.7087	90.6786	90.6786	94.7087	98.7389	102.7691	106.7992	110.8294 (44)
Energy conte	164.3568	143.7475	148.3345	129.3216	124.0872	107.0778	99.2233	113.8602	115.2201	134.2779	146.5748	159.1708 (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 = 1585.2524 (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	34.9258	30.5463	31.5211	27.4808	26.3685	22.7540	21.0850	24.1953	24.4843	28.5341	31.1471	33.8238 (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	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6104	22.7469	18.4990	14.0050	10.4689	8.8383	9.5500	12.4135	16.6614	21.1555	24.6916	26.3222	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	268.6506	271.4384	264.4133	249.4578	230.5792	212.8360	200.9824	198.1946	205.2197	220.1752	239.0538	256.7970	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	(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)	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	(71)
Water heating gains (Table 5)	46.9433	45.4559	42.3671	38.1678	35.4416	31.6028	28.3400	32.5206	34.0059	38.3522	43.2599	45.4621	(72)
Total internal gains	406.2384	404.6752	390.3135	366.6647	341.5237	318.3111	303.9065	308.1628	320.9211	344.7170	372.0394	393.6154	(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
North			5.4900		10.6334		0.7200		0.7000		0.7700		20.3896 (74)
South			4.2600		46.7521		0.7200		0.7000		0.7700		69.5623 (78)
West			1.8000		19.6403		0.7200		0.7000		0.7700		12.3476 (80)
South			3.8000		46.7521		0.7200		0.7000		0.7700		62.0509 (78)
Solar gains	164.3504	278.6687	380.5617	474.6933	537.7451	537.3626	516.5535	468.4188	412.6945	307.5342	196.5558	140.8778	(83)
Total gains	570.5888	683.3439	770.8752	841.3580	879.2689	855.6737	820.4600	776.5816	733.6155	652.2511	568.5951	534.4932	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.4245	21.4860	21.5467	21.8362	21.8912	22.1511	22.1511	22.1999	22.0503	21.8912	21.7802	21.6653	
alpha	2.4283	2.4324	2.4364	2.4557	2.4594	2.4767	2.4767	2.4800	2.4700	2.4594	2.4520	2.4444	
util living area	0.9669	0.9485	0.9203	0.8700	0.7888	0.6672	0.5395	0.5772	0.7499	0.8911	0.9519	0.9715	(86)
MIT	18.3139	18.6274	19.0969	19.6929	20.2379	20.6607	20.8584	20.8275	20.5087	19.7938	18.9480	18.2615	(87)
Th 2	19.9753	19.9779	19.9805	19.9926	19.9949	20.0055	20.0055	20.0075	20.0014	19.9949	19.9903	19.9855	(88)
util rest of house	0.9623	0.9414	0.9088	0.8498	0.7524	0.6028	0.4438	0.4843	0.6953	0.8701	0.9441	0.9675	(89)
MIT 2	17.5103	17.8215	18.2854	18.8743	19.3934	19.7803	19.9353	19.9171	19.6534	18.9826	18.1507	17.4653	(90)
Living area fraction	17.6368	17.9483	18.4131	19.0031	19.5263	19.9189	20.0806	20.0604	19.7880	19.1103	18.2762	17.5906	(92)
Temperature adjustment	17.6368	17.9483	18.4131	19.0031	19.5263	19.9189	20.0806	20.0604	19.7880	19.1103	18.2762	17.5906	(93)
adjusted MIT	17.6368	17.9483	18.4131	19.0031	19.5263	19.9189	20.0806	20.0604	19.7880	19.1103	18.2762	17.5906	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9477	0.9226	0.8862	0.8257	0.7328	0.5965	0.4516	0.4897	0.6818	0.8469	0.9261	0.9543	(94)
Ext temp.	540.7724	630.4654	683.1800	694.7351	644.3076	510.4504	370.5533	380.3202	500.1679	552.4020	526.6037	510.0798	(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	1629.6570	1589.8389	1447.4338	1211.2478	935.9258	628.6117	411.3516	431.6543	675.3042	1017.7206	1343.3386	1618.0423	(97)
Space heating kWh	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	810.1302	644.6990	568.6048	371.8891	216.9639	0.0000	0.0000	0.0000	0.0000	346.1970	588.0491	824.3241	(98)
Space heating per m2												4370.8573	(98)
												40.4709	(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	1110.9297	874.5617	896.2238	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7121	0.7791	0.7563	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	791.1061	681.3754	677.8295	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1110.1116	1066.6140	1017.5310	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	229.6839	286.6175	252.7380	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			769.0394 (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	57.4210	71.6544	63.1845	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												192.2599 (107)
Energy for space heating												1.7802 (108)
Energy for space cooling												40.4709 (99)
Total												1.7802 (108)
Dwelling Fabric Energy Efficiency (DFEE)												42.2511 (109)
												42.3 (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	54.0000 (1b)	x 2.4000 (2b)	= 129.6000 (1b) - (3b)
First floor	54.0000 (1c)	x 2.6800 (2c)	= 144.7200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.3200 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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) =	0.3661 (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	0.4668	0.4577	0.4485	0.4027	0.3936	0.3478	0.3478	0.3387	0.3661	0.3936	0.4119	0.4302 (22b)
Effective ac	0.6090	0.6047	0.6006	0.5811	0.5775	0.5605	0.5605	0.5573	0.5670	0.5775	0.5848	0.5925 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			15.3500	1.3258	20.3504		(27)
150mm EPS B&B			54.0000	0.1300	7.0200		(28a)
140mm Timber Frame	106.1700	17.4700	88.7000	0.1800	15.9660		(29a)
400mm Mineral Wool	54.0000		54.0000	0.1300	7.0200		(30)
Total net area of external elements Aum(A, m ²)			214.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.4764		(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)							10.5440 (36)
Total fabric heat loss						(33) + (36) =	63.0204 (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	55.1263	54.7433	54.3678	52.6045	52.2746	50.7387	50.7387	50.4543	51.3303	52.2746	52.9420	53.6397 (38)
Heat transfer coeff	118.1467	117.7636	117.3882	115.6249	115.2949	113.7591	113.7591	113.4747	114.3507	115.2949	115.9624	116.6601 (39)
Average = Sum(39)m / 12 =												115.6233 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0940	1.0904	1.0869	1.0706	1.0675	1.0533	1.0533	1.0507	1.0588	1.0675	1.0737	1.0802 (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												2.8023 (42)
Average daily hot water use (litres/day)												100.7540 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.8294	106.7992	102.7691	98.7389	94.7087	90.6786	90.6786	94.7087	98.7389	102.7691	106.7992	110.8294 (44)
Energy conte	164.3568	143.7475	148.3345	129.3216	124.0872	107.0778	99.2233	113.8602	115.2201	134.2779	146.5748	159.1708 (45)
Energy content (annual)										Total = Sum(45)m =		1585.2524 (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 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	34.9258	30.5463	31.5211	27.4808	26.3685	22.7540	21.0850	24.1953	24.4843	28.5341	31.1471	33.8238 (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	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136	140.1136 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6104	22.7469	18.4990	14.0050	10.4689	8.8383	9.5500	12.4135	16.6614	21.1555	24.6916	26.3222 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	268.6506	271.4384	264.4133	249.4578	230.5792	212.8360	200.9824	198.1946	205.2197	220.1752	239.0538	256.7970 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114	37.0114 (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)	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909 (71)
Water heating gains (Table 5)	46.9433	45.4559	42.3671	38.1678	35.4416	31.6028	28.3400	32.5206	34.0059	38.3522	43.2599	45.4621 (72)
Total internal gains	406.2384	404.6752	390.3135	366.6647	341.5237	318.3111	303.9065	308.1628	320.9211	344.7170	372.0394	393.6154 (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
North					5.4900	10.6334	0.6300	0.7000			0.7700	17.8409 (74)
South					8.0600	46.7521	0.6300	0.7000			0.7700	115.1616 (78)
West					1.8000	19.6403	0.6300	0.7000			0.7700	10.8042 (80)
Solar gains	143.8066	243.8351	332.9915	415.3566	470.5270	470.1923	451.9843	409.8664	361.1076	269.0924	171.9863	123.2681 (83)
Total gains	550.0450	648.5103	723.3050	782.0213	812.0507	788.5034	755.8908	718.0292	682.0287	613.8093	544.0257	516.8834 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	63.4804	63.6869	63.8906	64.8649	65.0506	65.9288	65.9288	66.0940	65.5877	65.0506	64.6762	64.2893
alpha	5.2320	5.2458	5.2594	5.3243	5.3367	5.3953	5.3953	5.4063	5.3725	5.3367	5.3117	5.2860
util living area	0.9991	0.9976	0.9936	0.9796	0.9335	0.8081	0.6361	0.6863	0.8975	0.9861	0.9979	0.9994 (86)
MIT	19.7494	19.9019	20.1348	20.4414	20.7226	20.9196	20.9826	20.9741	20.8436	20.4758	20.0573	19.7287 (87)
Th 2	20.0058	20.0087	20.0115	20.0249	20.0274	20.0391	20.0391	20.0413	20.0346	20.0274	20.0223	20.0170 (88)
util rest of house	0.9988	0.9968	0.9912	0.9710	0.9035	0.7267	0.5103	0.5628	0.8410	0.9788	0.9971	0.9991 (89)
MIT 2	18.8582	19.0128	19.2469	19.5600	19.8276	19.9987	20.0343	20.0332	19.9417	19.5982	19.1792	18.8467 (90)
Living area fraction									fLA = Living area / (4) =			0.1574 (91)
MIT	18.9985	19.1527	19.3867	19.6987	19.9684	20.1436	20.1835	20.1813	20.0837	19.7364	19.3175	18.9855 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9985	19.1527	19.3867	19.6987	19.9684	20.1436	20.1835	20.1813	20.0837	19.7364	19.3175	18.9855 (93)

8. Space heating requirement

Utilisation	0.9983	0.9958	0.9891	0.9674	0.9013	0.7367	0.5303	0.5822	0.8444	0.9758	0.9962	0.9988 (94)
Useful gains	549.1267	645.7908	715.4373	756.4991	731.9196	580.8916	400.8158	418.0015	575.9293	598.9787	541.9447	516.2634 (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	1736.5750	1678.4546	1512.7451	1248.6007	953.3099	630.6382	407.6607	429.0866	684.2370	1053.3775	1416.7650	1724.8791 (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	883.4615	693.9501	593.1970	354.3131	164.7144	0.0000	0.0000	0.0000	0.0000	338.0727	629.8706	899.2101 (98)
Space heating												4556.7895 (98)
Space heating per m2										(98) / (4) =		42.1925 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
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	1069.3355	841.8173	862.4076	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8281	0.9037	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	885.5065	760.7265	760.0685	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1031.6008	991.1435	949.0932	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	105.1879	171.4303	140.6344	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												417.2526 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	26.2970	42.8576	35.1586	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												104.3131 (107)
Space cooling per m2												0.9659 (108)
Energy for space heating												42.1925 (99)
Energy for space cooling												0.9659 (108)
Total												43.1584 (109)
Target Fabric Energy Efficiency (TFEE)												49.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	54.0000 (1b)	x 2.4000 (2b)	= 129.6000 (1b) - (3b)
First floor	54.0000 (1c)	x 2.6800 (2c)	= 144.7200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.3200 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.6500		
Number of sides sheltered															0.2325 (18)		
															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2151 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)					
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)					
Adj infilt rate																	
	0.2366	0.2204	0.2204	0.2097	0.2097	0.1989	0.1989	0.1882	0.1882	0.2043	0.1989	0.2097 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																	0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			11.5500	1.3258	15.3125		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			54.0000	0.1700	9.1800	75.0000	4050.0000 (28a)					
140mm Timber Frame	106.1700	17.4700	88.7000	0.1900	16.8530	9.0000	798.3000 (29a)					
400mm Mineral Wool	54.0000		54.0000	0.1100	5.9400	9.0000	486.0000 (30)					
Total net area of external elements Aum(A, m2)			214.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.0794		(33)					
Timebr Frame			47.3500	0.0000	0.0000	20.0000	947.0000 (32)					
Timber GF			68.3000			9.0000	614.7000 (32c)					
Timber FF			118.9400			9.0000	1070.4600 (32c)					
Internal Floor			54.0000			18.0000	972.0000 (32d)					
Internal Ceiling			54.0000			18.0000	972.0000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9910.4600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							91.7635 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.8394 (36)					
Total fabric heat loss						(33) + (36) =	67.9188 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 45.2628	Feb 45.2628	Mar 45.2628	Apr 45.2628	May 45.2628	Jun 45.2628	Jul 45.2628	Aug 45.2628	Sep 45.2628	Oct 45.2628	Nov 45.2628	Dec 45.2628 (38)
Heat transfer coeff	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816 (39)
Average = Sum(39)m / 12 =												113.1816 (39)
HLP	Jan 1.0480	Feb 1.0480	Mar 1.0480	Apr 1.0480	May 1.0480	Jun 1.0480	Jul 1.0480	Aug 1.0480	Sep 1.0480	Oct 1.0480	Nov 1.0480	Dec 1.0480 (40)
HLP (average)												1.0480 (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												2.8023 (42)
Average daily hot water use (litres/day)												100.7540 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	110.8294	106.7992	102.7691	98.7389	94.7087	90.6786	90.6786	94.7087	98.7389	102.7691	106.7992	110.8294 (44)
Energy conte	164.3568	143.7475	148.3345	129.3216	124.0872	107.0778	99.2233	113.8602	115.2201	134.2779	146.5748	159.1708 (45)
Energy content (annual)										Total = Sum (45)m =		1585.2524 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6535	21.5621	22.2502	19.3982	18.6131	16.0617	14.8835	17.0790	17.2830	20.1417	21.9862	23.8756 (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	14.1510	12.7703	14.1126	13.6193	14.0386	13.5458	13.9725	14.0154	13.5858	14.0788	13.6646	14.1386 (61)
Total heat required for water heating calculated for each month	178.5078	156.5178	162.4471	142.9409	138.1258	120.6236	113.1958	127.8756	128.8059	148.3567	160.2394	173.3093 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	178.5078	156.5178	162.4471	142.9409	138.1258	120.6236	113.1958	127.8756	128.8059	148.3567	160.2394	173.3093 (64)
RHI water heating demand										Total per year (kWh/year) = Sum (64)m =		1750.9457 (64)
Heat gains from water heating, kWh/month	58.1864	50.9886	52.8494	46.4043	44.7686	38.9898	36.4849	41.3624	41.7071	48.1671	52.1523	56.4589 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.0259	56.8673	46.2476	35.0124	26.1722	22.0956	23.8751	31.0338	41.6535	52.8887	61.7289	65.8054 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	400.9711	405.1319	394.6468	372.3251	344.1481	317.6656	299.9737	295.8129	306.2980	328.6197	356.7967	383.2792 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159 (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)	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909 (71)
Water heating gains (Table 5)	78.2075	75.8759	71.0341	64.4504	60.1729	54.1525	49.0388	55.5946	57.9266	64.7407	72.4337	75.8856 (72)
Total internal gains	656.8659	651.5364	625.5898	585.4492	544.1545	507.5752	486.5490	496.1026	519.5395	559.9104	604.6207	638.6316 (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	
North				5.4900	13.4839		0.7200		0.7000	0.7700	25.8554 (74)	
South				4.2600	56.7559		0.7200		0.7000	0.7700	84.4470 (78)	
West				1.8000	25.1925		0.7200		0.7000	0.7700	15.8383 (80)	
South				3.8000	56.7559		0.7200		0.7000	0.7700	75.3283 (78)	
Solar gains	201.4690	290.8231	401.7933	508.3694	548.8299	603.3629	558.7496	525.4117	458.0796	342.1739	240.1484	163.5023 (83)
Total gains	858.3348	942.3596	1027.3830	1093.8186	1092.9844	1110.9380	1045.2986	1021.5144	977.6191	902.0844	844.7691	802.1339 (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	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229
Feb	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215
Mar	0.9163	0.8935	0.8463	0.7689	0.6479	0.4701	0.3415	0.3486	0.5629	0.7663	0.8785	0.9259 (86)
MIT	19.2300	19.4326	19.8301	20.2698	20.6639	20.9006	20.9701	20.9685	20.8286	20.4082	19.7635	19.1713 (87)
Th 2	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435 (88)
util rest of house	0.9054	0.8798	0.8262	0.7377	0.5970	0.3955	0.2485	0.2540	0.4911	0.7272	0.8602	0.9159 (89)
MIT 2	17.7129	18.0004	18.5621	19.1701	19.6904	19.9653	20.0291	20.0283	19.8932	19.3700	18.4783	17.6305 (90)
Living area fraction	17.9517	18.2258	18.7617	19.3432	19.8436	20.1125	20.1772	20.1763	20.0405	19.5334	18.6806	17.8730 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8017	18.0758	18.6117	19.1932	19.6936	19.9625	20.0272	20.0263	19.8905	19.3834	18.5306	17.7230 (93)

8. Space heating requirement

Utilisation	0.8713	0.8438	0.7896	0.7056	0.5764	0.3888	0.2469	0.2522	0.4786	0.6957	0.8234	0.8831 (94)
Useful gains	747.8788	795.1866	811.2484	771.7477	630.0216	431.9818	258.0460	257.6596	467.9037	627.5407	695.5916	708.3556 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1403.6439	1378.0798	1246.3217	1040.5047	746.2743	459.8025	263.3933	263.2911	519.5548	835.6642	1146.5977	1383.4225 (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	487.8892	391.7042	323.6946	193.5051	86.4920	0.0000	0.0000	0.0000	0.0000	154.8439	324.7244	502.2498 (98)
Space heating												2465.1032 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

2465 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	54.0000 (1b)	x 2.4000 (2b)	= 129.6000 (1b) - (3b)
First floor	54.0000 (1c)	x 2.6800 (2c)	= 144.7200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.3200 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.6500
Infiltration rate												0.2325 (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) =	0.2151 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2742	0.2688	0.2635	0.2366	0.2312	0.2043	0.2043	0.1989	0.2151	0.2312	0.2419	0.2527 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5242	0.5188	0.5135	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5027 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			11.5500	1.3258	15.3125		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			54.0000	0.1700	9.1800	75.0000	4050.0000 (28a)					
140mm Timber Frame	106.1700	17.4700	88.7000	0.1900	16.8530	9.0000	798.3000 (29a)					
400mm Mineral Wool	54.0000		54.0000	0.1100	5.9400	9.0000	486.0000 (30)					
Total net area of external elements Aum(A, m2)			214.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.0794		(33)					
Timebr Frame			47.3500	0.0000	0.0000	20.0000	947.0000 (32)					
Timber GF			68.3000			9.0000	614.7000 (32c)					
Timber FF			118.9400			9.0000	1070.4600 (32c)					
Internal Floor			54.0000			18.0000	972.0000 (32d)					
Internal Ceiling			54.0000			18.0000	972.0000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9910.4600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							91.7635 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.8394 (36)					
Total fabric heat loss						(33) + (36) =	67.9188 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.4539	Feb 46.9672	Mar 46.4805	Apr 45.2628	May 45.2628	Jun 45.2628	Jul 45.2628	Aug 45.2628	Sep 45.2628	Oct 45.2628	Nov 45.2628	Dec 45.5071 (38)
Heat transfer coeff	115.3727	114.8860	114.3993	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.4259 (39)
Average = Sum(39)m / 12 =												113.6281 (39)
HLP	Jan 1.0683	Feb 1.0638	Mar 1.0593	Apr 1.0480	May 1.0480	Jun 1.0480	Jul 1.0480	Aug 1.0480	Sep 1.0480	Oct 1.0480	Nov 1.0480	Dec 1.0502 (40)
HLP (average)												1.0521 (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												2.8023 (42)
Average daily hot water use (litres/day)												100.7540 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	110.8294	106.7992	102.7691	98.7389	94.7087	90.6786	90.6786	94.7087	98.7389	102.7691	106.7992	110.8294 (44)
Energy conte	164.3568	143.7475	148.3345	129.3216	124.0872	107.0778	99.2233	113.8602	115.2201	134.2779	146.5748	159.1708 (45)
Energy content (annual)										Total = Sum (45)m =		1585.2524 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6535	21.5621	22.2502	19.3982	18.6131	16.0617	14.8835	17.0790	17.2830	20.1417	21.9862	23.8756 (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	14.1510	12.7703	14.1126	13.6193	14.0386	13.5458	13.9725	14.0154	13.5858	14.0788	13.6646	14.1386 (61)
Total heat required for water heating calculated for each month	178.5078	156.5178	162.4471	142.9409	138.1258	120.6236	113.1958	127.8756	128.8059	148.3567	160.2394	173.3093 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	178.5078	156.5178	162.4471	142.9409	138.1258	120.6236	113.1958	127.8756	128.8059	148.3567	160.2394	173.3093 (64)
Heat gains from water heating, kWh/month	58.1864	50.9886	52.8494	46.4043	44.7686	38.9898	36.4849	41.3624	41.7071	48.1671	52.1523	56.4589 (65)
										Total per year (kWh/year) = Sum (64)m =		1750.9457 (64)

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	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.0259	56.8673	46.2476	35.0124	26.1722	22.0956	23.8751	31.0338	41.6535	52.8887	61.7289	65.8054 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	400.9711	405.1319	394.6468	372.3251	344.1481	317.6656	299.9737	295.8129	306.2980	328.6197	356.7967	383.2792 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159 (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)	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909 (71)
Water heating gains (Table 5)	78.2075	75.8759	71.0341	64.4504	60.1729	54.1525	49.0388	55.5946	57.9266	64.7407	72.4337	75.8856 (72)
Total internal gains	656.8659	651.5364	625.5898	585.4492	544.1545	507.5752	486.5490	496.1026	519.5395	559.9104	604.6207	638.6316 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	5.4900	10.6334	0.7200	0.7000	0.7700	20.3896 (74)
South	4.2600	46.7521	0.7200	0.7000	0.7700	69.5623 (78)
West	1.8000	19.6403	0.7200	0.7000	0.7700	12.3476 (80)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509 (78)

Solar gains	164.3504	278.6687	380.5617	474.6933	537.7451	537.3626	516.5535	468.4188	412.6945	307.5342	196.5558	140.8778 (83)
Total gains	821.2163	930.2051	1006.1515	1060.1425	1081.8996	1044.9378	1003.1025	964.5214	932.2339	867.4446	801.1765	779.5094 (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	23.8610	23.9621	24.0640	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.2705
alpha	2.5907	2.5975	2.6043	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6180
util living area	0.9339	0.9089	0.8718	0.8090	0.7139	0.5824	0.4532	0.4845	0.6572	0.8233	0.9084	0.9408 (86)
MIT	18.9195	19.1956	19.5931	20.0747	20.4934	20.7908	20.9215	20.9036	20.6958	20.1632	19.4717	18.8828 (87)
Th 2	20.0268	20.0305	20.0342	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0417 (88)
util rest of house	0.9255	0.8976	0.8555	0.7834	0.6731	0.5185	0.3679	0.3999	0.5984	0.7945	0.8951	0.9331 (89)
MIT 2	17.2563	17.6530	18.2215	18.9032	19.4712	19.8469	19.9888	19.9729	19.7395	19.0384	18.0635	17.2126 (90)
Living area fraction	17.5181	17.8958	18.4374	19.0876	19.6321	19.9955	20.1356	20.1194	19.8900	19.2155	18.2851	17.4755 (91)
MIT	17.5181	17.8958	18.4374	19.0876	19.6321	19.9955	20.1356	20.1194	19.8900	19.2155	18.2851	17.4755 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3681	17.7458	18.2874	18.9376	19.4821	19.8455	19.9856	19.9694	19.7400	19.0655	18.1351	17.3255 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8936	0.8624	0.8184	0.7484	0.6460	0.5042	0.3625	0.3929	0.5776	0.7588	0.8600	0.9031 (94)
Ext temp.	733.8798	802.1761	823.4183	793.4266	698.9539	526.8227	363.5894	378.9383	538.4230	658.2365	689.0181	703.9899 (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	1507.7067	1475.8012	1348.4742	1136.0676	880.7931	593.6942	383.1918	403.9920	638.3429	958.1366	1248.9747	1488.7672 (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	575.7272	452.6761	390.6416	246.7015	135.2884	0.0000	0.0000	0.0000	0.0000	223.1257	403.1688	583.8743 (98)
Space heating per m2												3011.2036 (98)
										(98) / (4) =		27.8815 (99)

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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													3327.2968 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	575.7272	452.6761	390.6416	246.7015	135.2884	0.0000	0.0000	0.0000	0.0000	223.1257	403.1688	583.8743	(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)	636.1627	500.1946	431.6482	272.5983	149.4899	0.0000	0.0000	0.0000	0.0000	246.5477	445.4904	645.1650	(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	178.5078	156.5178	162.4471	142.9409	138.1258	120.6236	113.1958	127.8756	128.8059	148.3567	160.2394	173.3093	(64)
Efficiency of water heater (217)m	89.7216	89.6557	89.5361	89.2992	88.8546	87.3000	87.3000	87.3000	87.3000	89.1943	89.5663	87.3000	(216)
Fuel for water heating, kWh/month	198.9573	174.5766	181.4320	160.0696	155.4515	138.1714	129.6630	146.4783	147.5440	166.3298	178.9060	193.1087	(219)
Water heating fuel used												1970.6883	(219)
Annual totals kWh/year													
Space heating fuel - main system												3327.2968	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)												76.7842	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												151.7842	(231)
Electricity for lighting (calculated in Appendix L)												452.2872	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1080 * 1.00) =										-518.1718		-518.1718	(233)
Total delivered energy for all uses												5383.8846	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3327.2968	3.4800	115.7899	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1970.6883	3.4800	68.5800	(247)
Mechanical ventilation fans	76.7842	13.1900	10.1278	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	452.2872	13.1900	59.6567	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-518.1718	13.1900	-68.3469	(252)
Total energy cost			315.7000	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8666	(257)
SAP value		87.9105	
SAP rating (Section 12)		88	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3327.2968	0.2160	718.6961	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1970.6883	0.2160	425.6687	(264)
Space and water heating			1144.3648	(265)
Pumps and fans	151.7842	0.5190	78.7760	(267)
Energy for lighting	452.2872	0.5190	234.7370	(268)
Energy saving/generation technologies				
PV Unit	-518.1718	0.5190	-268.9312	(269)
Total kg/year			1188.9467	(272)
CO2 emissions per m2			11.0100	(273)
EI value			89.5870	

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EI rating
EI band

90 (274)
B

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	$3.48 / 0.8873 = 3.922$, stars = 4
Water heating environmental impact	$0.216 / 0.8873 = 0.2434$, 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	54.0000 (1b)	x 2.4000 (2b)	= 129.6000 (1b) - (3b)
First floor	54.0000 (1c)	x 2.6800 (2c)	= 144.7200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.3200 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.6500		
Number of sides sheltered															0.2325 (18)		
															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2151 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)					
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)					
Adj infilt rate																	
	0.2366	0.2204	0.2204	0.2097	0.2097	0.1989	0.1989	0.1882	0.1882	0.2043	0.1989	0.2097 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																	0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			11.5500	1.3258	15.3125		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			54.0000	0.1700	9.1800	75.0000	4050.0000 (28a)					
140mm Timber Frame	106.1700	17.4700	88.7000	0.1900	16.8530	9.0000	798.3000 (29a)					
400mm Mineral Wool	54.0000		54.0000	0.1100	5.9400	9.0000	486.0000 (30)					
Total net area of external elements Aum(A, m2)			214.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.0794		(33)					
Timebr Frame			47.3500	0.0000	0.0000	20.0000	947.0000 (32)					
Timber GF			68.3000			9.0000	614.7000 (32c)					
Timber FF			118.9400			9.0000	1070.4600 (32c)					
Internal Floor			54.0000			18.0000	972.0000 (32d)					
Internal Ceiling			54.0000			18.0000	972.0000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9910.4600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							91.7635 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.8394 (36)					
Total fabric heat loss						(33) + (36) =	67.9188 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 45.2628	Feb 45.2628	Mar 45.2628	Apr 45.2628	May 45.2628	Jun 45.2628	Jul 45.2628	Aug 45.2628	Sep 45.2628	Oct 45.2628	Nov 45.2628	Dec 45.2628 (38)
Heat transfer coeff	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816 (39)
Average = Sum(39)m / 12 =												113.1816 (39)
HLP	Jan 1.0480	Feb 1.0480	Mar 1.0480	Apr 1.0480	May 1.0480	Jun 1.0480	Jul 1.0480	Aug 1.0480	Sep 1.0480	Oct 1.0480	Nov 1.0480	Dec 1.0480 (40)
HLP (average)												1.0480 (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												2.8023 (42)
Average daily hot water use (litres/day)												100.7540 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Calculation Type: New Build (As Built)

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

Daily hot water use	110.8294	106.7992	102.7691	98.7389	94.7087	90.6786	90.6786	94.7087	98.7389	102.7691	106.7992	110.8294 (44)
Energy conte	164.3568	143.7475	148.3345	129.3216	124.0872	107.0778	99.2233	113.8602	115.2201	134.2779	146.5748	159.1708 (45)
Energy content (annual)										Total = Sum (45)m =		1585.2524 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6535	21.5621	22.2502	19.3982	18.6131	16.0617	14.8835	17.0790	17.2830	20.1417	21.9862	23.8756 (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	14.1510	12.7703	14.1126	13.6193	14.0386	13.5458	13.9725	14.0154	13.5858	14.0788	13.6646	14.1386 (61)
Total heat required for water heating calculated for each month	178.5078	156.5178	162.4471	142.9409	138.1258	120.6236	113.1958	127.8756	128.8059	148.3567	160.2394	173.3093 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	178.5078	156.5178	162.4471	142.9409	138.1258	120.6236	113.1958	127.8756	128.8059	148.3567	160.2394	173.3093 (64)
Heat gains from water heating, kWh/month	58.1864	50.9886	52.8494	46.4043	44.7686	38.9898	36.4849	41.3624	41.7071	48.1671	52.1523	56.4589 (65)
Total per year (kWh/year) = Sum (64)m = 1750.9457 (64)												

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	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.0259	56.8673	46.2476	35.0124	26.1722	22.0956	23.8751	31.0338	41.6535	52.8887	61.7289	65.8054 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	400.9711	405.1319	394.6468	372.3251	344.1481	317.6656	299.9737	295.8129	306.2980	328.6197	356.7967	383.2792 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159 (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)	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909 (71)
Water heating gains (Table 5)	78.2075	75.8759	71.0341	64.4504	60.1729	54.1525	49.0388	55.5946	57.9266	64.7407	72.4337	75.8856 (72)
Total internal gains	656.8659	651.5364	625.5898	585.4492	544.1545	507.5752	486.5490	496.1026	519.5395	559.9104	604.6207	638.6316 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	5.4900	13.4839	0.7200	0.7000	0.7700	25.8554 (74)
South	4.2600	56.7559	0.7200	0.7000	0.7700	84.4470 (78)
West	1.8000	25.1925	0.7200	0.7000	0.7700	15.8383 (80)
South	3.8000	56.7559	0.7200	0.7000	0.7700	75.3283 (78)

Solar gains	201.4690	290.8231	401.7933	508.3694	548.8299	603.3629	558.7496	525.4117	458.0796	342.1739	240.1484	163.5023 (83)
Total gains	858.3348	942.3596	1027.3830	1093.8186	1092.9844	1110.9380	1045.2986	1021.5144	977.6191	902.0844	844.7691	802.1339 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229
alpha	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215
util living area	0.9163	0.8935	0.8463	0.7689	0.6479	0.4701	0.3415	0.3486	0.5629	0.7663	0.8785	0.9259 (86)
MIT	19.2300	19.4326	19.8301	20.2698	20.6639	20.9006	20.9701	20.9685	20.8286	20.4082	19.7635	19.1713 (87)
Th 2	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435 (88)
util rest of house	0.9054	0.8798	0.8262	0.7377	0.5970	0.3955	0.2485	0.2540	0.4911	0.7272	0.8602	0.9159 (89)
MIT 2	17.7129	18.0004	18.5621	19.1701	19.6904	19.9653	20.0291	20.0283	19.8932	19.3700	18.4783	17.6305 (90)
Living area fraction	17.9517	18.2258	18.7617	19.3432	19.8436	20.1125	20.1772	20.1763	20.0405	19.5334	18.6806	17.8730 (91)
MIT	17.9517	18.2258	18.7617	19.3432	19.8436	20.1125	20.1772	20.1763	20.0405	19.5334	18.6806	17.8730 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8017	18.0758	18.6117	19.1932	19.6936	19.9625	20.0272	20.0263	19.8905	19.3834	18.5306	17.7230 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8713	0.8438	0.7896	0.7056	0.5764	0.3888	0.2469	0.2522	0.4786	0.6957	0.8234	0.8831 (94)
Ext temp.	747.8788	795.1866	811.2484	771.7477	630.0216	431.9818	258.0460	257.6596	467.9037	627.5407	695.5916	708.3556 (95)
Heat loss rate W	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Month fracti	1403.6439	1378.0798	1246.3217	1040.5047	746.2743	459.8025	263.3933	263.2911	519.5548	835.6642	1146.5977	1383.4225 (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	487.8892	391.7042	323.6946	193.5051	86.4920	0.0000	0.0000	0.0000	0.0000	154.8439	324.7244	502.2498 (98)
Space heating per m2												2465.1032 (98)
(98) / (4) =												22.8250 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2723.8709 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	487.8892	391.7042	323.6946	193.5051	86.4920	0.0000	0.0000	0.0000	0.0000	154.8439	324.7244	502.2498	(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)	539.1041	432.8223	357.6736	213.8178	95.5713	0.0000	0.0000	0.0000	0.0000	171.0982	358.8115	554.9722	(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	178.5078	156.5178	162.4471	142.9409	138.1258	120.6236	113.1958	127.8756	128.8059	148.3567	160.2394	173.3093	(64)
Efficiency of water heater (217)m	89.6200	89.5627	89.4049	89.1122	88.5050	87.3000	87.3000	87.3000	87.3000	88.9054	89.4170	89.6569	(216)
Fuel for water heating, kWh/month	199.1829	174.7577	181.6982	160.4054	156.0655	138.1714	129.6630	146.4783	147.5440	166.8702	179.2046	193.3028	(219)
Water heating fuel used												1973.3440	(219)
Annual totals kWh/year													
Space heating fuel - main system												2723.8709	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)												76.7842	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												151.7842	(231)
Electricity for lighting (calculated in Appendix L)												452.2872	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1201 * 1.00) =											-576.2844	-576.2844	(233)
Total delivered energy for all uses												4725.0020	(238)

10a. Fuel costs - using BEDF prices (508)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2723.8709	3.7400	101.8728 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1973.3440	3.7400	73.8031 (247)
Mechanical ventilation fans	76.7842	20.4300	15.6870 (249)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	452.2872	20.4300	92.4023 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-576.2844	20.4300	-117.7349 (252)
Total energy cost			276.3527 (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	2723.8709	0.2160	588.3561 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1973.3440	0.2160	426.2423 (264)
Space and water heating			1014.5984 (265)
Pumps and fans	151.7842	0.5190	78.7760 (267)
Energy for lighting	452.2872	0.5190	234.7370 (268)
Energy saving/generation technologies			
PV Unit	-576.2844	0.5190	-299.0916 (269)
Total kg/year			1029.0199 (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	2723.8709	1.2200	3323.1225 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1973.3440	1.2200	2407.4797 (264)
Space and water heating			5730.6022 (265)
Pumps and fans	151.7842	3.0700	465.9776 (267)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy for lighting	452.2872	3.0700	1388.5216 (268)
Energy saving/generation technologies			
PV Unit	-576.2844	3.0700	-1769.1930 (269)
Primary energy kWh/year			5815.9084 (272)
Primary energy kWh/m ² /year			53.8510 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(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	+ 1.1	-£ 28	-195 kg (18.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£28 1.81 kg/m ²	B 89	B 91
Total Savings	£28 1.81 kg/m ²		

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

Fuel prices for cost data on this page from database revision number 508 TEST (28 Oct 2022)
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	£123	£134	-£10
Mains gas	£271	£232	£38
Space heating	£228	£228	£0
Water heating	£74	£46	£28
Lighting	£92	£92	£0
Generated (PV)	-£118	-£118	£0
Total cost of fuels	£276	£248	£28
Total cost of uses	£276	£248	£28
Delivered energy	44 kWh/m ²	35 kWh/m ²	9 kWh/m ²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m ²	10 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	54 kWh/m ²	44 kWh/m ²	10 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	54.0000 (1b)	x 2.4000 (2b)	= 129.6000 (1b) - (3b)
First floor	54.0000 (1c)	x 2.6800 (2c)	= 144.7200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.3200 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.6500
Infiltration rate												0.2325 (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) =	0.2151 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2742	0.2688	0.2635	0.2366	0.2312	0.2043	0.2043	0.1989	0.2151	0.2312	0.2419	0.2527 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5242	0.5188	0.5135	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5027 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			11.5500	1.3258	15.3125		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			54.0000	0.1700	9.1800	75.0000	4050.0000 (28a)					
140mm Timber Frame	106.1700	17.4700	88.7000	0.1900	16.8530	9.0000	798.3000 (29a)					
400mm Mineral Wool	54.0000		54.0000	0.1100	5.9400	9.0000	486.0000 (30)					
Total net area of external elements Aum(A, m2)			214.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.0794		(33)					
Timebr Frame			47.3500	0.0000	0.0000	20.0000	947.0000 (32)					
Timber GF			68.3000			9.0000	614.7000 (32c)					
Timber FF			118.9400			9.0000	1070.4600 (32c)					
Internal Floor			54.0000			18.0000	972.0000 (32d)					
Internal Ceiling			54.0000			18.0000	972.0000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9910.4600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							91.7635 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.8394 (36)					
Total fabric heat loss						(33) + (36) =	67.9188 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.4539	Feb 46.9672	Mar 46.4805	Apr 45.2628	May 45.2628	Jun 45.2628	Jul 45.2628	Aug 45.2628	Sep 45.2628	Oct 45.2628	Nov 45.2628	Dec 45.5071 (38)
Heat transfer coeff	115.3727	114.8860	114.3993	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.4259 (39)
Average = Sum(39)m / 12 =												113.6281 (39)
HLP	Jan 1.0683	Feb 1.0638	Mar 1.0593	Apr 1.0480	May 1.0480	Jun 1.0480	Jul 1.0480	Aug 1.0480	Sep 1.0480	Oct 1.0480	Nov 1.0480	Dec 1.0502 (40)
HLP (average)												1.0521 (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												2.8023 (42)
Average daily hot water use (litres/day)												100.7540 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	110.8294	106.7992	102.7691	98.7389	94.7087	90.6786	90.6786	94.7087	98.7389	102.7691	106.7992	110.8294 (44)
Energy conte	164.3568	143.7475	148.3345	129.3216	124.0872	107.0778	99.2233	113.8602	115.2201	134.2779	146.5748	159.1708 (45)
Energy content (annual)										Total = Sum (45)m =		1585.2524 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6535	21.5621	22.2502	19.3982	18.6131	16.0617	14.8835	17.0790	17.2830	20.1417	21.9862	23.8756 (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	14.1510	12.7703	14.1126	13.6193	14.0386	13.5458	13.9725	14.0154	13.5858	14.0788	13.6646	14.1386 (61)
Total heat required for water heating calculated for each month	178.5078	156.5178	162.4471	142.9409	138.1258	120.6236	113.1958	127.8756	128.8059	148.3567	160.2394	173.3093 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1440 (H8)
Utilisation factor												0.5828 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.7540 (H14)
Volume ratio Veff/V												0.7444 (H15)
Solar storage volume factor												0.9410 (H16)
Solar input												-874.4526 (H17)
Solar input	-25.3574	-42.3142	-72.0659	-96.5825	-119.3195	-117.3101	-115.7598	-101.1399	-79.2129	-54.0931	-30.0775	-21.2198 (63)
Solar input (sum of months) = Sum (63)m =												-874.4526 (63)
Output from w/h	153.1504	114.2036	90.3812	46.3584	18.8062	3.3135	0.0000	26.7356	49.5931	94.2637	130.1619	152.0895 (64)
Total per year (kWh/year) = Sum (64)m =												879.0570 (64)
Heat gains from water heating, kWh/month	58.1864	50.9886	52.8494	46.4043	44.7686	38.9898	36.4849	41.3624	41.7071	48.1671	52.1523	56.4589 (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	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.0259	56.8673	46.2476	35.0124	26.1722	22.0956	23.8751	31.0338	41.6535	52.8887	61.7289	65.8054	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	400.9711	405.1319	394.6468	372.3251	344.1481	317.6656	299.9737	295.8129	306.2980	328.6197	356.7967	383.2792	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	(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)	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	(71)
Water heating gains (Table 5)	78.2075	75.8759	71.0341	64.4504	60.1729	54.1525	49.0388	55.5946	57.9266	64.7407	72.4337	75.8856	(72)
Total internal gains	656.8659	651.5364	625.5898	585.4492	544.1545	507.5752	486.5490	496.1026	519.5395	559.9104	604.6207	638.6316	(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				
North				5.4900	10.6334	0.7200	0.7000	0.7700	20.3896 (74)				
South				4.2600	46.7521	0.7200	0.7000	0.7700	69.5623 (78)				
West				1.8000	19.6403	0.7200	0.7000	0.7700	12.3476 (80)				
South				3.8000	46.7521	0.7200	0.7000	0.7700	62.0509 (78)				

Solar gains	164.3504	278.6687	380.5617	474.6933	537.7451	537.3626	516.5535	468.4188	412.6945	307.5342	196.5558	140.8778	(83)
Total gains	821.2163	930.2051	1006.1515	1060.1425	1081.8996	1044.9378	1003.1025	964.5214	932.2339	867.4446	801.1765	779.5094	(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	23.8610	23.9621	24.0640	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.2705	
alpha	2.5907	2.5975	2.6043	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6180	
util living area	0.9339	0.9089	0.8718	0.8090	0.7139	0.5824	0.4532	0.4845	0.6572	0.8233	0.9084	0.9408	(86)
MIT	18.9195	19.1956	19.5931	20.0747	20.4934	20.7908	20.9215	20.9036	20.6958	20.1632	19.4717	18.8828	(87)
Th 2	20.0268	20.0305	20.0342	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0417	(88)
util rest of house	0.9255	0.8976	0.8555	0.7834	0.6731	0.5185	0.3679	0.3999	0.5984	0.7945	0.8951	0.9331	(89)
MIT 2	17.2563	17.6530	18.2215	18.9032	19.4712	19.8469	19.9888	19.9729	19.7395	19.0384	18.0635	17.2126	(90)
Living area fraction									fLA = Living area / (4) =			0.1574	(91)
MIT	17.5181	17.8958	18.4374	19.0876	19.6321	19.9955	20.1356	20.1194	19.8900	19.2155	18.2851	17.4755	(92)
Temperature adjustment												-0.1500	

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

adjusted MIT 17.3681 17.7458 18.2874 18.9376 19.4821 19.8455 19.9856 19.9694 19.7400 19.0655 18.1351 17.3255 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8936	0.8624	0.8184	0.7484	0.6460	0.5042	0.3625	0.3929	0.5776	0.7588	0.8600	0.9031	(94)
Useful gains	733.8798	802.1761	823.4183	793.4266	698.9539	526.8227	363.5894	378.9383	538.4230	658.2365	689.0181	703.9899	(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	1507.7067	1475.8012	1348.4742	1136.0676	880.7931	593.6942	383.1918	403.9920	638.3429	958.1366	1248.9747	1488.7672	(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	575.7272	452.6761	390.6416	246.7015	135.2884	0.0000	0.0000	0.0000	0.0000	223.1257	403.1688	583.8743	(98)
Space heating												3011.2036	(98)
Space heating per m2												27.8815	(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													3327.2968 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	575.7272	452.6761	390.6416	246.7015	135.2884	0.0000	0.0000	0.0000	0.0000	223.1257	403.1688	583.8743	(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)	636.1627	500.1946	431.6482	272.5983	149.4899	0.0000	0.0000	0.0000	0.0000	246.5477	445.4904	645.1650	(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	153.1504	114.2036	90.3812	46.3584	18.8062	3.3135	0.0000	26.7356	49.5931	94.2637	130.1619	152.0895	(64)
Efficiency of water heater (217)m	89.8083	89.8366	89.8810	89.9783	90.0969	87.3000	87.3000	87.3000	87.3000	89.5254	89.6976	89.8196	(216)
Fuel for water heating, kWh/month	170.5303	127.1237	100.5565	51.5218	20.8733	3.7955	0.0000	30.6250	56.8076	105.2927	145.1119	169.3277	(219)
Water heating fuel used												981.5661	(219)
Annual totals kWh/year													
Space heating fuel - main system												3327.2968	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													76.7842 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													201.7842 (231)
Electricity for lighting (calculated in Appendix L)													452.2872 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1080 * 1.00) =										-518.1718		-518.1718	(233)
Total delivered energy for all uses												4444.7625	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3327.2968	3.4800	115.7899	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	981.5661	3.4800	34.1585	(247)
Mechanical ventilation fans	76.7842	13.1900	10.1278	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	452.2872	13.1900	59.6567	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-518.1718	13.1900	-68.3469	(252)
Total energy cost			287.8736	(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] =	0.7902 (257)
SAP value		88.9761
SAP rating (Section 12)		89 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP band

B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3327.2968	0.2160	718.6961 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	981.5661	0.2160	212.0183 (264)
Space and water heating			930.7144 (265)
Pumps and fans	201.7842	0.5190	104.7260 (267)
Energy for lighting	452.2872	0.5190	234.7370 (268)
Energy saving/generation technologies			
PV Unit	-518.1718	0.5190	-268.9312 (269)
Total kg/year			1001.2463 (272)
CO2 emissions per m2			9.2700 (273)
EI value			91.2309
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	54.0000 (1b)	x 2.4000 (2b)	= 129.6000 (1b) - (3b)
First floor	54.0000 (1c)	x 2.6800 (2c)	= 144.7200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.3200 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.6500		
Number of sides sheltered															0.2325 (18)		
															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2151 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)					
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)					
Adj infilt rate																	
	0.2366	0.2204	0.2204	0.2097	0.2097	0.1989	0.1989	0.1882	0.1882	0.2043	0.1989	0.2097 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																	0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			11.5500	1.3258	15.3125		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			54.0000	0.1700	9.1800	75.0000	4050.0000 (28a)					
140mm Timber Frame	106.1700	17.4700	88.7000	0.1900	16.8530	9.0000	798.3000 (29a)					
400mm Mineral Wool	54.0000		54.0000	0.1100	5.9400	9.0000	486.0000 (30)					
Total net area of external elements Aum(A, m2)			214.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.0794		(33)					
Timebr Frame			47.3500	0.0000	0.0000	20.0000	947.0000 (32)					
Timber GF			68.3000			9.0000	614.7000 (32c)					
Timber FF			118.9400			9.0000	1070.4600 (32c)					
Internal Floor			54.0000			18.0000	972.0000 (32d)					
Internal Ceiling			54.0000			18.0000	972.0000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9910.4600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							91.7635 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.8394 (36)					
Total fabric heat loss						(33) + (36) =	67.9188 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 45.2628	Feb 45.2628	Mar 45.2628	Apr 45.2628	May 45.2628	Jun 45.2628	Jul 45.2628	Aug 45.2628	Sep 45.2628	Oct 45.2628	Nov 45.2628	Dec 45.2628 (38)
Heat transfer coeff	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816	113.1816 (39)
Average = Sum(39)m / 12 =												113.1816 (39)
HLP	Jan 1.0480	Feb 1.0480	Mar 1.0480	Apr 1.0480	May 1.0480	Jun 1.0480	Jul 1.0480	Aug 1.0480	Sep 1.0480	Oct 1.0480	Nov 1.0480	Dec 1.0480 (40)
HLP (average)												1.0480 (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												2.8023 (42)
Average daily hot water use (litres/day)												100.7540 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	110.8294	106.7992	102.7691	98.7389	94.7087	90.6786	90.6786	94.7087	98.7389	102.7691	106.7992	110.8294 (44)
Energy conte	164.3568	143.7475	148.3345	129.3216	124.0872	107.0778	99.2233	113.8602	115.2201	134.2779	146.5748	159.1708 (45)
Energy content (annual)										Total = Sum (45)m =		1585.2524 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6535	21.5621	22.2502	19.3982	18.6131	16.0617	14.8835	17.0790	17.2830	20.1417	21.9862	23.8756 (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	14.1510	12.7703	14.1126	13.6193	14.0386	13.5458	13.9725	14.0154	13.5858	14.0788	13.6646	14.1386 (61)
Total heat required for water heating calculated for each month	178.5078	156.5178	162.4471	142.9409	138.1258	120.6236	113.1958	127.8756	128.8059	148.3567	160.2394	173.3093 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2723 (H8)
Utilisation factor												0.5443 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.7540 (H14)
Volume ratio Veff/V												0.7444 (H15)
Solar storage volume factor												0.9410 (H16)
Solar input												-908.3612 (H17)
Solar input	-29.8195	-42.4014	-72.8779	-98.3291	-114.9217	-123.9063	-117.9491	-107.5029	-84.0029	-57.7695	-35.2686	-23.6121 (63)
Solar input (sum of months) = Sum (63)m =												-908.3612 (63)
Output from w/h	148.6883	114.1163	89.5692	44.6118	23.2041	0.0000	0.0000	20.3727	44.8030	90.5872	124.9708	149.6972 (64)
Total per year (kWh/year) = Sum (64)m =												850.6204 (64)
Heat gains from water heating, kWh/month	58.1864	50.9886	52.8494	46.4043	44.7686	38.9898	36.4849	41.3624	41.7071	48.1671	52.1523	56.4589 (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	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	168.1364	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.0259	56.8673	46.2476	35.0124	26.1722	22.0956	23.8751	31.0338	41.6535	52.8887	61.7289	65.8054	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	400.9711	405.1319	394.6468	372.3251	344.1481	317.6656	299.9737	295.8129	306.2980	328.6197	356.7967	383.2792	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	54.6159	(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)	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	-112.0909	(71)
Water heating gains (Table 5)	78.2075	75.8759	71.0341	64.4504	60.1729	54.1525	49.0388	55.5946	57.9266	64.7407	72.4337	75.8856	(72)
Total internal gains	656.8659	651.5364	625.5898	585.4492	544.1545	507.5752	486.5490	496.1026	519.5395	559.9104	604.6207	638.6316	(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
North				5.4900	13.4839		0.7200		0.7000		0.7700		25.8554 (74)
South				4.2600	56.7559		0.7200		0.7000		0.7700		84.4470 (78)
West				1.8000	25.1925		0.7200		0.7000		0.7700		15.8383 (80)
South				3.8000	56.7559		0.7200		0.7000		0.7700		75.3283 (78)

Solar gains	201.4690	290.8231	401.7933	508.3694	548.8299	603.3629	558.7496	525.4117	458.0796	342.1739	240.1484		163.5023 (83)
Total gains	858.3348	942.3596	1027.3830	1093.8186	1092.9844	1110.9380	1045.2986	1021.5144	977.6191	902.0844	844.7691		802.1339 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	24.3229	
alpha	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	2.6215	
util living area	0.9163	0.8935	0.8463	0.7689	0.6479	0.4701	0.3415	0.3486	0.5629	0.7663	0.8785	0.9259	(86)
MIT	19.2300	19.4326	19.8301	20.2698	20.6639	20.9006	20.9701	20.9685	20.8286	20.4082	19.7635	19.1713	(87)
Th 2	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	20.0435	(88)
util rest of house	0.9054	0.8798	0.8262	0.7377	0.5970	0.3955	0.2485	0.2540	0.4911	0.7272	0.8602	0.9159	(89)
MIT 2	17.7129	18.0004	18.5621	19.1701	19.6904	19.9653	20.0291	20.0283	19.8932	19.3700	18.4783	17.6305	(90)
Living area fraction	17.9517	18.2258	18.7617	19.3432	19.8436	20.1125	20.1772	20.1763	20.0405	19.5334	18.6806	17.8730	(92)
MIT													
Temperature adjustment													-0.1500

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adjusted MIT 17.8017 18.0758 18.6117 19.1932 19.6936 19.9625 20.0272 20.0263 19.8905 19.3834 18.5306 17.7230 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8713	0.8438	0.7896	0.7056	0.5764	0.3888	0.2469	0.2522	0.4786	0.6957	0.8234	0.8831	(94)
Useful gains	747.8788	795.1866	811.2484	771.7477	630.0216	431.9818	258.0460	257.6596	467.9037	627.5407	695.5916	708.3556	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1403.6439	1378.0798	1246.3217	1040.5047	746.2743	459.8025	263.3933	263.2911	519.5548	835.6642	1146.5977	1383.4225	(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	487.8892	391.7042	323.6946	193.5051	86.4920	0.0000	0.0000	0.0000	0.0000	154.8439	324.7244	502.2498	(98)
Space heating												2465.1032	(98)
Space heating per m2												22.8250	(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													2723.8709 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	487.8892	391.7042	323.6946	193.5051	86.4920	0.0000	0.0000	0.0000	0.0000	154.8439	324.7244	502.2498	(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)	539.1041	432.8223	357.6736	213.8178	95.5713	0.0000	0.0000	0.0000	0.0000	171.0982	358.8115	554.9722	(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	148.6883	114.1163	89.5692	44.6118	23.2041	0.0000	0.0000	20.3727	44.8030	90.5872	124.9708	149.6972	(64)
Efficiency of water heater (217)m	89.7317	89.7577	89.7867	89.8827	89.8037	87.3000	87.3000	87.3000	87.3000	89.2919	89.5874	89.7447	(217)
Fuel for water heating, kWh/month	165.7031	127.1381	99.7578	49.6333	25.8387	0.0000	0.0000	23.3364	51.3207	101.4506	139.4959	166.8034	(219)
Water heating fuel used												950.4780	(219)
Annual totals kWh/year													
Space heating fuel - main system												2723.8709	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													76.7842 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													201.7842 (231)
Electricity for lighting (calculated in Appendix L)													452.2872 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1201 * 1.00) =										-576.2844		-576.2844	(233)
Total delivered energy for all uses												3752.1359	(238)

10a. Fuel costs - using BEDF prices (508)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2723.8709	3.7400	101.8728	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	950.4780	3.7400	35.5479	(247)
Mechanical ventilation fans	76.7842	20.4300	15.6870	(249)
Pumps and fans for heating	75.0000	20.4300	15.3225	(249)
Pump for solar water heating	50.0000	20.4300	10.2150	(249)
Energy for lighting	452.2872	20.4300	92.4023	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-576.2844	20.4300	-117.7349	(252)
Total energy cost			248.3125	(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	2723.8709	0.2160	588.3561	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)

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Water heating (other fuel)	950.4780	0.2160	205.3032 (264)
Space and water heating			793.6594 (265)
Pumps and fans	201.7842	0.5190	104.7260 (267)
Energy for lighting	452.2872	0.5190	234.7370 (268)
Energy saving/generation technologies			
PV Unit	-576.2844	0.5190	-299.0916 (269)
Total kg/year			834.0308 (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	2723.8709	1.2200	3323.1225 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	950.4780	1.2200	1159.5832 (264)
Space and water heating			4482.7057 (265)
Pumps and fans	201.7842	3.0700	619.4776 (267)
Energy for lighting	452.2872	3.0700	1388.5216 (268)
Energy saving/generation technologies			
PV Unit	-576.2844	3.0700	-1769.1930 (269)
Primary energy kWh/year			4721.5119 (272)
Primary energy kWh/m2/year			43.7177 (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
Overshading	Average or unknown
Thermal mass parameter	91.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	362.10 (P1)
Transmission heat loss coefficient	67.92 (P7)
Summer heat loss coefficient	430.02 (P2)

Overhangs

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

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	5.4900	87.1704	0.7200	0.7000	0.9000	195.3697
South	4.2600	118.5567	0.7200	0.7000	0.9000	206.1822
West	1.8000	125.2818	0.7200	0.7000	0.9000	92.0611
South	3.8000	118.5567	0.7200	0.7000	0.9000	183.9184

total: 677.5313

Solar gains	Jun 723	Jul 678	Aug 623	(P3)
Internal gains	505	484	493	
Total summer gains	1228	1161	1117	(P5)

Summer gain/loss ratio	2.86	2.70	2.60	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 91.8)	1.36	1.36	1.36	
Threshold temperature	19.61	21.36	21.25	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight