

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-212			Issued on Date	08/09/2023
Assessment Reference	As Built	Prop Type Ref	GF Flat Semi		
Property	48, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	83 B	DER	14.95	TER	20.37
Environmental	90 B	% DER<TER	26.62		
CO ₂ Emissions (t/year)	0.60	DFEE	49.08	TFEE	50.92
General Requirements Compliance	Pass	% DFEE<TFEE	3.62		
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

Ground-floor flat, total floor area 51 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) 20.37 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.95 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 49.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (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	(no roof)		
Openings	1.38 (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: 4.97 (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 30
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): Medium OK
Based on:
Overshading: Average
Windows facing North: 2.16 m², No overhang
Windows facing South: 6.50 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.63 W/m²K
Photovoltaic array 432.08 kWh/Year

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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	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.9700
Infiltration rate					0.2485 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2112 (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	0.2693	0.2640	0.2588	0.2323	0.2271	0.2007	0.2007	0.1954	0.2112	0.2271	0.2376	0.2482 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5193	0.5140	0.5088	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)			6.5400	1.3258	8.6705		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
150mm EPS B&B			50.6800	0.1700	8.6156	75.0000	3801.0000 (28a)
140mm Timber Frame	44.1500	10.7800	33.3700	0.1900	6.3403	9.0000	300.3300 (29a)
WTS	15.8900		15.8900	0.1500	2.3835	18.0000	286.0200 (29a)
Total net area of external elements Aum(A, m2)			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.5765		(33)
Timebr Frame			15.8900	0.0000	0.0000	20.0000	317.8000 (32)
Party Ceilings			50.6800			30.0000	1520.4000 (32b)
Timber			113.4100			9.0000	1020.6900 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			7246.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							142.9803 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5561 (36)
Total fabric heat loss					(33) + (36) =		43.1325 (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	21.8867	21.6641	21.4415	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727 (38)
Heat transfer coeff	65.0192	64.7966	64.5741	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053 (39)
Average = Sum(39)m / 12 =												64.3531 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2829	1.2785	1.2742	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669 (40)
HLP (average)												1.2698 (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												1.7101 (42)
Average daily hot water use (litres/day)												74.8157 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	82.2973	79.3047	76.3120	73.3194	70.3268	67.3341	67.3341	70.3268	73.3194	76.3120	79.3047	82.2973 (44)
Energy conte	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)

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Energy content (annual)												Total = Sum(45)m = 1177.1425 (45)
Distribution loss (46)m = 0.15 x (45)m												
18.3067	16.0111	16.5221	14.4043	13.8213	11.9267	11.0519	12.6822	12.8336	14.9564	16.3261	17.7290	(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	14.5182	13.0950	14.4691	13.9695	14.4113	13.9189	14.3657	14.3953	13.9465	14.4452	14.0172	(61)
Total heat required for water heating calculated for each month												
136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023	(64)
Heat gains from water heating, kWh/month												
44.2094	38.7651	40.2412	35.4220	34.2400	29.9173	28.0897	31.7110	31.9345	36.7646	39.6937	42.9265	(65)
Total per year (kWh/year) = Sum(64)m =												1347.2033 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
13.6874	12.1571	9.8868	7.4849	5.5951	4.7236	5.1040	6.6344	8.9047	11.3065	13.1964	14.0679	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
148.9999	150.5461	146.6498	138.3551	127.8846	118.0438	111.4695	109.9234	113.8196	122.1143	132.5848	142.4256	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)												
59.4212	57.6862	54.0876	49.1972	46.0216	41.5518	37.7550	42.6223	44.3535	49.4148	55.1302	57.6970	(72)
Total internal gains	273.7606	272.0413	262.2762	246.6893	231.1533	215.9713	205.9806	210.8321	218.7299	234.4876	252.5634	265.8425 (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				2.1600	10.6334	0.7200	0.7000		0.7700		8.0221 (74)	
South				4.3800	46.7521	0.7200	0.7000		0.7700		71.5218 (78)	
South				2.1200	46.7521	0.7200	0.7000		0.7700		34.6179 (78)	
Solar gains	114.1618	189.1602	247.4785	292.1056	317.1557	311.3163	301.5541	282.8358	262.6289	205.7406	135.7081	98.4021 (83)
Total gains	387.9224	461.2015	509.7548	538.7949	548.3090	527.2875	507.5347	493.6679	481.3587	440.2282	388.2715	364.2446 (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	30.9577	31.0640	31.1711	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	
alpha	3.0638	3.0709	3.0781	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	
util living area	0.9721	0.9528	0.9235	0.8726	0.7867	0.6548	0.5122	0.5423	0.7233	0.8850	0.9554	0.9766 (86)
MIT	19.0850	19.3666	19.7390	20.1676	20.5502	20.8219	20.9388	20.9250	20.7426	20.2453	19.5848	19.0382 (87)
Th 2	19.8542	19.8577	19.8611	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669 (88)
util rest of house	0.9666	0.9437	0.9083	0.8456	0.7384	0.5717	0.3970	0.4289	0.6493	0.8552	0.9451	0.9719 (89)
MIT 2	17.3357	17.7419	18.2752	18.8792	19.3919	19.7210	19.8341	19.8238	19.6375	18.9985	18.0674	17.2759 (90)
Living area fraction												
MIT	18.0537	18.4087	18.8760	19.4079	19.8673	20.1728	20.2875	20.2757	20.0910	19.5102	18.6902	17.9992 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9037	18.2587	18.7260	19.2579	19.7173	20.0228	20.1375	20.1257	19.9410	19.3602	18.5402	17.8492 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9534	0.9268	0.8892	0.8284	0.7311	0.5842	0.4261	0.4565	0.6547	0.8390	0.9290	0.9601 (94)
Useful gains	369.8573	427.4307	453.2817	446.3414	400.8940	308.0175	216.2600	225.3531	315.1466	369.3327	360.7130	349.7219 (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	884.4986	865.5986	789.4826	665.0348	514.7522	348.1730	227.1262	239.2114	375.0251	562.4506	734.5187	876.3492 (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	382.8932	294.4489	250.1335	157.4592	84.7105	0.0000	0.0000	0.0000	0.0000	143.6797	269.1401	391.8107 (98)
Space heating												1974.2759 (98)
Space heating per m2												(98) / (4) = 38.9557 (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													2181.5203	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	382.8932	294.4489	250.1335	157.4592	84.7105	0.0000	0.0000	0.0000	0.0000	143.6797	269.1401	391.8107	(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)	423.0864	325.3579	276.3906	173.9881	93.6028	0.0000	0.0000	0.0000	0.0000	158.7621	297.3924	432.9400	(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	136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023	(64)	
Efficiency of water heater (217)m	89.6362	89.5505	89.4102	89.1559	88.6889	87.3000	87.3000	87.3000	87.3000	89.0547	89.4721	89.6684	(216)	
Fuel for water heating, kWh/month	152.3522	133.8194	139.3758	123.3775	120.1427	107.0223	100.8532	113.3369	113.9795	128.1845	137.3138	147.9922	(219)	
Water heating fuel used												1517.7500	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2181.5203	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)														
mechanical ventilation fans (SFP = 0.2260)													35.2058	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													110.2058	(231)
Electricity for lighting (calculated in Appendix L)													241.7246	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
Total delivered energy for all uses													4051.2007	(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	2181.5203	0.2160	471.2084 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1517.7500	0.2160	327.8340 (264)
Space and water heating			799.0424 (265)
Pumps and fans	110.2058	0.5190	57.1968 (267)
Energy for lighting	241.7246	0.5190	125.4550 (268)
Energy saving/generation technologies			
PV Unit	-432.0800	0.5190	-224.2495 (269)
Total CO2, kg/year			757.4447 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9500 (273)

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

DER			14.9500	ZC1
Total Floor Area		TFA	50.6800	
Assumed number of occupants		N	1.7101	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.4219	ZC2
CO2 emissions from cooking, equation (L16)			3.1579	ZC3
Total CO2 emissions			35.5298	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			35.5298	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (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					2 * 10 = 20.0000 (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) =				20.0000 / (5) = 0.1566 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4066 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3456 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4407	0.4320	0.4234	0.3802	0.3715	0.3283	0.3283	0.3197	0.3456	0.3715	0.3888	0.4061 (22b)
	0.5971	0.5933	0.5896	0.5723	0.5690	0.5539	0.5539	0.5511	0.5597	0.5690	0.5756	0.5825 (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)			8.6600	1.3258	11.4811		(27)
150mm EPS B&B			50.6800	0.1300	6.5884		(28a)
140mm Timber Frame	44.1500	10.7800	33.3700	0.1800	6.0066		(29a)
WTS	15.8900		15.8900	0.1800	2.8602		(29a)
Total net area of external elements Aum, m ²			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 29.0563		(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)							7.8061 (36)
Total fabric heat loss						(33) + (36) =	36.8624 (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	25.1645	25.0057	24.8499	24.1184	23.9815	23.3444	23.3444	23.2264	23.5898	23.9815	24.2584	24.5479 (38)
Heat transfer coeff	62.0269	61.8680	61.7123	60.9808	60.8439	60.2068	60.2068	60.0888	60.4522	60.8439	61.1208	61.4102 (39)
Average = Sum(39)m / 12 =												60.9801 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2239	1.2208	1.2177	1.2033	1.2006	1.1880	1.1880	1.1857	1.1928	1.2006	1.2060	1.2117 (40)
HLP (average)												1.2032 (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												1.7101 (42)
Average daily hot water use (litres/day)												74.8157 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	82.2973	79.3047	76.3120	73.3194	70.3268	67.3341	67.3341	70.3268	73.3194	76.3120	79.3047	82.2973 (44)
Energy conte	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)
Energy content (annual)												1177.1425 (45)
Distribution loss (46)m = 0.15 x (45)m	18.3067	16.0111	16.5221	14.4043	13.8213	11.9267	11.0519	12.6822	12.8336	14.9564	16.3261	17.7290 (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)

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Combi loss	41.9378	36.5019	38.8878	36.1575	35.8378	33.2059	34.3127	35.8378	36.1575	38.8878	39.1091	41.9378 (61)
Total heat required for water heating calculated for each month	163.9823	143.2428	149.0348	132.1864	127.9797	112.7174	107.9919	120.3856	121.7151	138.5969	147.9495	160.1314 (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	163.9823	143.2428	149.0348	132.1864	127.9797	112.7174	107.9919	120.3856	121.7151	138.5969	147.9495	160.1314 (64)
Heat gains from water heating, kWh/month	51.0642	44.6168	46.3458	40.9690	39.5966	34.7391	33.0765	37.0716	37.4873	42.8752	45.9667	49.7838 (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	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.6874	12.1571	9.8868	7.4849	5.5951	4.7236	5.1040	6.6344	8.9047	11.3065	13.1964	14.0679	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.9999	150.5461	146.6498	138.3551	127.8846	118.0438	111.4695	109.9234	113.8196	122.1143	132.5848	142.4256	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	(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)	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)	68.6347	66.3941	62.2928	56.9014	53.2213	48.2487	44.4576	49.8274	52.0657	57.6280	63.8426	66.9137	(72)
Total internal gains	282.9741	280.7492	270.4814	254.3935	238.3530	222.6681	212.6832	218.0372	226.4420	242.7009	261.2759	275.0593	(73)

6. Solar gains

[Jan]												Gains	
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		W
North	2.1600				10.6334		0.6300		0.7000		0.7700		7.0194 (74)
South	6.5000				46.7521		0.6300		0.7000		0.7700		92.8723 (78)
Solar gains	99.8916	165.5152	216.5437	255.5924	277.5113	272.4017	263.8598	247.4813	229.8003	180.0230	118.7446	86.1019	(83)
Total gains	382.8657	446.2644	487.0251	509.9859	515.8643	495.0699	476.5430	465.5185	456.2423	422.7239	380.0205	361.1611	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7406	56.8863	57.0299	57.7140	57.8438	58.4560	58.4560	58.5708	58.2187	57.8438	57.5818	57.3104	
alpha	4.7827	4.7924	4.8020	4.8476	4.8563	4.8971	4.8971	4.9047	4.8812	4.8563	4.8388	4.8207	
util living area	0.9946	0.9881	0.9747	0.9418	0.8652	0.7128	0.5415	0.5742	0.7907	0.9483	0.9886	0.9959 (86)	
MIT	19.8022	19.9844	20.2309	20.5272	20.7805	20.9403	20.9874	20.9832	20.8964	20.5742	20.1307	19.7685 (87)	
Th 2	19.9009	19.9034	19.9059	19.9174	19.9196	19.9296	19.9296	19.9315	19.9257	19.9196	19.9152	19.9106 (88)	
util rest of house	0.9928	0.9842	0.9661	0.9209	0.8161	0.6186	0.4171	0.4505	0.7083	0.9255	0.9842	0.9945 (89)	
MIT 2	18.3274	18.5931	18.9493	19.3739	19.7068	19.8902	19.9251	19.9248	19.8475	19.4468	18.8156	18.2852 (90)	
Living area fraction									fLA = Living area / (4) =			0.4104 (91)	
MIT	18.9327	19.1641	19.4753	19.8472	20.1475	20.3212	20.3611	20.3592	20.2780	19.9095	19.3554	18.8939 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.9327	19.1641	19.4753	19.8472	20.1475	20.3212	20.3611	20.3592	20.2780	19.9095	19.3554	18.8939 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9906	0.9808	0.9619	0.9193	0.8277	0.6552	0.4686	0.5016	0.7378	0.9253	0.9812	0.9927 (94)
Useful gains	379.2746	437.6957	468.4633	468.8249	426.9914	324.3488	223.2952	233.4969	336.6151	391.1372	372.8644	358.5266 (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	907.6191	882.4924	800.7370	667.5701	513.9786	344.4529	226.4425	237.9034	373.4742	566.4257	749.0574	902.3588 (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	393.0883	298.9034	247.2117	143.0966	64.7184	0.0000	0.0000	0.0000	0.0000	130.4147	270.8590	404.6112 (98)
Space heating												1952.9032 (98)
Space heating per m2										(98) / (4) =		38.5340 (99)

8c. Space cooling requirement

Not applicable

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

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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												2090.9028	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	393.0883	298.9034	247.2117	143.0966	64.7184	0.0000	0.0000	0.0000	0.0000	130.4147	270.8590	404.6112	(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)	420.8654	320.0250	264.6806	153.2083	69.2917	0.0000	0.0000	0.0000	0.0000	139.6303	289.9989	433.2025	(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	163.9823	143.2428	149.0348	132.1864	127.9797	112.7174	107.9919	120.3856	121.7151	138.5969	147.9495	160.1314	(64)
Efficiency of water heater	87.1725	86.8606	86.3166	85.2511	83.4306	80.3000	80.3000	80.3000	80.3000	84.8984	86.5542	87.2870	(216)
(217)m													(217)
Fuel for water heating, kWh/month	188.1125	164.9112	172.6607	155.0553	153.3966	140.3704	134.4855	149.9198	151.5755	163.2503	170.9329	183.4539	(219)
Water heating fuel used												1928.1246	(219)
Annual totals kWh/year													
Space heating fuel - main system												2090.9028	(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)												241.7246	(232)
Total delivered energy for all uses												4335.7519	(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	2090.9028	0.2160	451.6350 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1928.1246	0.2160	416.4749 (264)
Space and water heating			868.1099 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	241.7246	0.5190	125.4550 (268)
Total CO2, kg/m2/year			1032.4900 (272)
Emissions per m2 for space and water heating			17.1292 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4754 (272b)
Emissions per m2 for pumps and fans			0.7681 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.1292 * 1.00) + 2.4754 + 0.7681, rounded to 2 d.p.			20.3700 (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	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (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					2 * 10 = 20.0000 (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) =				20.0000 / (5) = 0.1566 (8)
Pressure test					Yes
Measured/design AP50					4.9700
Infiltration rate					0.4051 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3443 (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												
	0.4390	0.4304	0.4218	0.3788	0.3702	0.3271	0.3271	0.3185	0.3443	0.3702	0.3874	0.4046 (22b)
Effective ac	0.5964	0.5926	0.5890	0.5717	0.5685	0.5535	0.5535	0.5507	0.5593	0.5685	0.5750	0.5818 (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)			6.5400	1.3258	8.6705		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
150mm EPS B&B			50.6800	0.1700	8.6156	75.0000	3801.0000 (28a)
140mm Timber Frame	44.1500	10.7800	33.3700	0.1900	6.3403	9.0000	300.3300 (29a)
WTS	15.8900		15.8900	0.1500	2.3835	18.0000	286.0200 (29a)
Total net area of external elements Aum(A, m ²)			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5765		(33)
Timber Frame			15.8900	0.0000	0.0000	20.0000	317.8000 (32)
Party Ceilings			50.6800			20.0000	1013.6000 (32b)
Timber			113.4100			9.0000	1020.6900 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 6739.4400 (34)
132.9803 (35)
11.5561 (36)
(33) + (36) = 43.1325 (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	25.1344	24.9767	24.8221	24.0960	23.9601	23.3277	23.3277	23.2105	23.5713	23.9601	24.2349	24.5223 (38)
Heat transfer coeff	68.2670	68.1092	67.9546	67.2285	67.0926	66.4602	66.4602	66.3431	66.7038	67.0926	67.3675	67.6548 (39)
Average = Sum(39)m / 12 =												67.2279 (39)
HLP	1.3470	1.3439	1.3409	1.3265	1.3238	1.3114	1.3114	1.3091	1.3162	1.3238	1.3293	1.3349 (40)
HLP (average)												1.3265 (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												1.7101 (42)
Average daily hot water use (litres/day)												74.8157 (43)
Daily hot water use	82.2973	79.3047	76.3120	73.3194	70.3268	67.3341	67.3341	70.3268	73.3194	76.3120	79.3047	82.2973 (44)
Energy conte	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)
Energy content (annual)										Total = Sum(45)m =		1177.1425 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(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	(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	(59)
Heat gains from water heating, kWh/month	25.9345	22.6824	23.4062	20.4061	19.5802	16.8962	15.6568	17.9664	18.1810	21.1882	23.1286	(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	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.6874	12.1571	9.8868	7.4849	5.5951	4.7236	5.1040	6.6344	8.9047	11.3065	13.1964	14.0679	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.9999	150.5461	146.6498	138.3551	127.8846	118.0438	111.4695	109.9234	113.8196	122.1143	132.5848	142.4256	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	(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)	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)	34.8581	33.7536	31.4600	28.3419	26.3174	23.4669	21.0441	24.1484	25.2514	28.4788	32.1230	33.7582	(72)
Total internal gains	246.1975	245.1088	236.6486	222.8340	208.4492	194.8864	186.2697	189.3582	196.6277	210.5516	226.5563	238.9038	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	2.1600	10.6334	0.7200		0.7000	0.7700	8.0221 (74)
South	4.3800	46.7521	0.7200		0.7000	0.7700	71.5218 (78)
South	2.1200	46.7521	0.7200		0.7000	0.7700	34.6179 (78)

Solar gains	114.1618	189.1602	247.4785	292.1056	317.1557	311.3163	301.5541	282.8358	262.6289	205.7406	135.7081	98.4021	(83)
Total gains	360.3594	434.2690	484.1272	514.9395	525.6049	506.2026	487.8237	472.1940	459.2566	416.2922	362.2643	337.3059	(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	27.4227	27.4862	27.5488	27.8463	27.9027	28.1682	28.1682	28.2180	28.0654	27.9027	27.7889	27.6709	
alpha	2.8282	2.8324	2.8366	2.8564	2.8602	2.8779	2.8779	2.8812	2.8710	2.8602	2.8526	2.8447	
util living area	0.9734	0.9549	0.9275	0.8800	0.8007	0.6745	0.5356	0.5667	0.7425	0.8934	0.9581	0.9776	(86)
MIT	18.8033	19.1007	19.5049	19.9916	20.4311	20.7642	20.9125	20.8943	20.6652	20.0874	19.3518	18.7470	(87)
Th 2	19.8042	19.8066	19.8090	19.8201	19.8222	19.8319	19.8319	19.8337	19.8282	19.8222	19.8180	19.8136	(88)
util rest of house	0.9682	0.9463	0.9132	0.8545	0.7542	0.5918	0.4161	0.4499	0.6701	0.8656	0.9486	0.9732	(89)
MIT 2	17.8295	18.1233	18.5201	18.9970	19.4062	19.6966	19.7987	19.7906	19.6196	19.0984	18.3829	17.7806	(90)
Living area fraction									fLA = Living area / (4) =			0.4104	(91)
MIT	18.2292	18.5244	18.9243	19.4052	19.8268	20.1347	20.2558	20.2436	20.0487	19.5043	18.7806	18.1772	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2292	18.5244	18.9243	19.4052	19.8268	20.1347	20.2558	20.2436	20.0487	19.5043	18.7806	18.1772	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9591	0.9345	0.9001	0.8440	0.7544	0.6151	0.4620	0.4937	0.6853	0.8565	0.9378	0.9651	(94)
Ext temp.	345.6101	405.8259	435.7578	434.6071	396.5061	311.3491	225.3811	233.1179	314.7243	356.5650	339.7451	325.5245	(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	950.9012	927.9477	844.2871	706.2471	545.2505	367.8405	242.9655	254.9935	396.8031	597.4127	786.8916	945.6266	(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 per m2	450.3366	350.8658	303.9458	195.5808	110.6658	0.0000	0.0000	0.0000	0.0000	179.1907	321.9454	461.3560	(98)
												2373.8869	(98)
												46.8407	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	624.7259	491.8055	504.2075	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7602	0.8275	0.8117	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	474.9448	406.9925	409.2475	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	656.5105	633.8160	616.5601	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	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	130.7274	168.7567	154.2405	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												453.7246 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	32.6818	42.1892	38.5601	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												113.4311 (107)
Space cooling per m2												2.2382 (108)
Energy for space heating												46.8407 (99)
Energy for space cooling												2.2382 (108)
Total												49.0789 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (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					2 * 10 = 20.0000 (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					20.0000 / (5) = 0.1566 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4066 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3456 (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												
	0.4407	0.4320	0.4234	0.3802	0.3715	0.3283	0.3283	0.3197	0.3456	0.3715	0.3888	0.4061 (22b)
Effective ac	0.5971	0.5933	0.5896	0.5723	0.5690	0.5539	0.5539	0.5511	0.5597	0.5690	0.5756	0.5825 (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)			8.6600	1.3258	11.4811		(27)
150mm EPS B&B			50.6800	0.1300	6.5884		(28a)
140mm Timber Frame	44.1500	10.7800	33.3700	0.1800	6.0066		(29a)
WTS	15.8900		15.8900	0.1800	2.8602		(29a)
Total net area of external elements Aum, m ²			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.0563		(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)							7.8061 (36)
Total fabric heat loss						(33) + (36) =	36.8624 (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	25.1645	25.0057	24.8499	24.1184	23.9815	23.3444	23.3444	23.2264	23.5898	23.9815	24.2584	24.5479 (38)
Heat transfer coeff	62.0269	61.8680	61.7123	60.9808	60.8439	60.2068	60.2068	60.0888	60.4522	60.8439	61.1208	61.4102 (39)
Average = Sum(39)m / 12 =												60.9801 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2239	1.2208	1.2177	1.2033	1.2006	1.1880	1.1880	1.1857	1.1928	1.2006	1.2060	1.2117 (40)
HLP (average)												1.2032 (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												1.7101 (42)
Average daily hot water use (litres/day)												74.8157 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	82.2973	79.3047	76.3120	73.3194	70.3268	67.3341	67.3341	70.3268	73.3194	76.3120	79.3047	82.2973 (44)
Energy conte	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)
Energy content (annual)												1177.1425 (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)

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 (59)
Heat gains from water heating, kWh/month	25.9345	22.6824	23.4062	20.4061	19.5802	16.8962	15.6568	17.9664	18.1810	21.1882	23.1286	25.1161 (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	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.6874	12.1571	9.8868	7.4849	5.5951	4.7236	5.1040	6.6344	8.9047	11.3065	13.1964	14.0679	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.9999	150.5461	146.6498	138.3551	127.8846	118.0438	111.4695	109.9234	113.8196	122.1143	132.5848	142.4256	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	(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)	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)	34.8581	33.7536	31.4600	28.3419	26.3174	23.4669	21.0441	24.1484	25.2514	28.4788	32.1230	33.7582	(72)
Total internal gains	246.1975	245.1088	236.6486	222.8340	208.4492	194.8864	186.2697	189.3582	196.6277	210.5516	226.5563	238.9038	(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					2.1600	10.6334		0.6300	0.7000	0.7700		7.0194 (74)	
South					6.5000	46.7521		0.6300	0.7000	0.7700		92.8723 (78)	
Solar gains	99.8916	165.5152	216.5437	255.5924	277.5113	272.4017	263.8598	247.4813	229.8003	180.0230	118.7446	86.1019 (83)	
Total gains	346.0891	410.6240	453.1924	478.4263	485.9604	467.2881	450.1295	436.8395	426.4280	390.5747	345.3008	325.0056 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7406	56.8863	57.0299	57.7140	57.8438	58.4560	58.4560	58.5708	58.2187	57.8438	57.5818	57.3104	
alpha	4.7827	4.7924	4.8020	4.8476	4.8563	4.8971	4.8971	4.9047	4.8812	4.8563	4.8388	4.8207	
util living area	0.9965	0.9915	0.9808	0.9532	0.8857	0.7418	0.5696	0.6064	0.8207	0.9609	0.9923	0.9974	(86)
MIT	19.7365	19.9225	20.1756	20.4828	20.7513	20.9288	20.9844	20.9788	20.8765	20.5272	20.0701	19.7034	(87)
Th 2	19.9009	19.9034	19.9059	19.9174	19.9196	19.9296	19.9296	19.9315	19.9257	19.9196	19.9152	19.9106	(88)
util rest of house	0.9953	0.9887	0.9741	0.9356	0.8409	0.6484	0.4406	0.4784	0.7422	0.9426	0.9893	0.9965	(89)
MIT 2	18.7614	18.9480	19.1995	19.5059	19.7516	19.8967	19.9257	19.9256	19.8601	19.5544	19.1050	18.7361	(90)
Living area fraction									fLA = Living area / (4) =			0.4104	(91)
MIT	19.1616	19.3479	19.6002	19.9068	20.1619	20.3203	20.3602	20.3578	20.2773	19.9537	19.5011	19.1331	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1616	19.3479	19.6002	19.9068	20.1619	20.3203	20.3602	20.3578	20.2773	19.9537	19.5011	19.1331	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9942	0.9869	0.9717	0.9354	0.8523	0.6849	0.4942	0.5315	0.7706	0.9433	0.9877	0.9956	(94)
Ext temp.	344.0873	405.2271	440.3840	447.5400	414.1706	320.0472	222.4336	232.1751	328.6148	368.4429	341.0706	323.5893	(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	921.8190	893.8658	808.4402	671.2050	514.8561	344.3991	226.3889	237.8216	373.4293	569.1135	757.9640	917.0465	(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	429.8323	328.3653	273.8338	161.0388	74.9101	0.0000	0.0000	0.0000	0.0000	149.2990	300.1633	441.5322	(98)
Space heating per m2												2158.9747	(98)
												42.6001	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	565.9435	445.5300	456.6746	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8606	0.9234	0.9107	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	487.0485	411.4085	415.8951	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	611.0260	589.7578	575.2366	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	89.2638	132.6919	118.5501	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												340.5058	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	22.3160	33.1730	29.6375	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												85.1265 (107)
Energy for space heating												1.6797 (108)
Energy for space cooling												42.6001 (99)
Total												1.6797 (108)
Target Fabric Energy Efficiency (TFEE)												44.2798 (109)
												50.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							4.9700					
Infiltration rate							0.2485	(18)				
Number of sides sheltered							2	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.8500 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.2112 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.2323	0.2165	0.2165	0.2059	0.2059	0.1954	0.1954	0.1848	0.1848	0.2007	0.1954	0.2059 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			6.5400	1.3258	8.6705		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
150mm EPS B&B			50.6800	0.1700	8.6156	75.0000	3801.0000 (28a)
140mm Timber Frame	44.1500	10.7800	33.3700	0.1900	6.3403	9.0000	300.3300 (29a)
WTS	15.8900		15.8900	0.1500	2.3835	18.0000	286.0200 (29a)
Total net area of external elements Aum(A, m ²)			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			31.5765	(33)
Timber Frame			15.8900	0.0000	0.0000	20.0000	317.8000 (32)
Party Ceilings			50.6800			30.0000	1520.4000 (32b)
Timber			113.4100			9.0000	1020.6900 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7246.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							142.9803 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5561 (36)
Total fabric heat loss							(33) + (36) = 43.1325 (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	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727 (38)
Heat transfer coeff	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053 (39)
Average = Sum(39)m / 12 =												64.2053 (39)
HLP	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669 (40)
HLP (average)												1.2669 (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												1.7101 (42)
Average daily hot water use (litres/day)												74.8157 (43)
Daily hot water use	Jan 82.2973	Feb 79.3047	Mar 76.3120	Apr 73.3194	May 70.3268	Jun 67.3341	Jul 67.3341	Aug 70.3268	Sep 73.3194	Oct 76.3120	Nov 79.3047	Dec 82.2973 (44)
Energy conte	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1177.1425 (45)
Distribution loss (46)m = 0.15 x (45)m												
	18.3067	16.0111	16.5221	14.4043	13.8213	11.9267	11.0519	12.6822	12.8336	14.9564	16.3261	17.7290 (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	14.5182	13.0950	14.4691	13.9695	14.4113	13.9189	14.3657	14.3953	13.9465	14.4452	14.0172	14.5087 (61)
Total heat required for water heating calculated for each month	136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
												Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h	136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023 (64)
												Total per year (kWh/year) = Sum(64)m = 1347.2033 (64)
RHI water heating demand												1347 (64)
Heat gains from water heating, kWh/month	44.2094	38.7651	40.2412	35.4220	34.2400	29.9173	28.0897	31.7110	31.9345	36.7646	39.6937	42.9265 (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	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.2186	30.3927	24.7170	18.7123	13.9877	11.8090	12.7600	16.5860	22.2617	28.2663	32.9910	35.1697	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.3879	224.6956	218.8803	206.5002	190.8726	176.1848	166.3724	164.0647	169.8800	182.2601	197.8878	212.5756	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	(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)	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)	59.4212	57.6862	54.0876	49.1972	46.0216	41.5518	37.7550	42.6223	44.3535	49.4148	55.1302	57.6970	(72)
Total internal gains	400.2014	396.9481	381.8585	358.5834	335.0555	313.7193	301.0612	307.4467	320.6689	344.1149	370.1826	389.6159	(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				2.1600	13.4839	0.7200	0.7000	0.7700	10.1726 (74)			
South				4.3800	56.7559	0.7200	0.7000	0.7700	86.8258 (78)			
South				2.1200	56.7559	0.7200	0.7000	0.7700	42.0253 (78)			
Solar gains	139.0236	195.7098	258.3440	309.0345	320.2642	346.3037	322.9575	313.5378	288.0248	226.6971	164.6192	113.5152 (83)
Total gains	539.2250	592.6579	640.2025	667.6179	655.3197	660.0229	624.0187	620.9845	608.6937	570.8120	534.8018	503.1311 (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	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501
alpha	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900
util living area	0.9260	0.9020	0.8536	0.7763	0.6519	0.4657	0.3315	0.3330	0.5444	0.7601	0.8844	0.9360 (86)
MIT	19.6370	19.8197	20.1483	20.4899	20.7829	20.9456	20.9863	20.9862	20.9061	20.6093	20.0882	19.5773 (87)
Th 2	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669 (88)
util rest of house	0.9124	0.8845	0.8274	0.7353	0.5859	0.3731	0.2213	0.2223	0.4542	0.7075	0.8603	0.9238 (89)
MIT 2	18.1305	18.3861	18.8418	19.3002	19.6660	19.8334	19.8627	19.8626	19.8003	19.4645	18.7693	18.0479 (90)
Living area fraction	fLA = Living area / (4) = 0.4104 (91)											
MIT	18.7488	18.9744	19.3780	19.7885	20.1244	20.2899	20.3239	20.3238	20.2541	19.9344	19.3106	18.6756 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.5988	18.8244	19.2280	19.6385	19.9744	20.1399	20.1739	20.1738	20.1041	19.7844	19.1606	18.5256 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8932	0.8649	0.8101	0.7261	0.5926	0.3963	0.2518	0.2529	0.4741	0.7032	0.8423	0.9053 (94)
Useful gains	481.6533	512.5799	518.6542	484.7768	388.3573	261.5749	157.1025	157.0725	288.5955	401.4155	450.4383	455.4739 (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	847.4299	829.8177	746.5794	618.8403	441.3744	272.2213	158.8354	158.8285	308.4497	499.7967	690.8882	836.3113 (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	272.1378	213.1838	169.5763	96.5257	39.4447	0.0000	0.0000	0.0000	0.0000	73.1956	173.1239	283.3430 (98)
Space heating												1320.5309 (98)
RHI space heating demand												1321 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					0.0000 / (5) = 0.0000 (8)
Measured/design AP50					Yes
Infiltration rate					4.9700
Number of sides sheltered					0.2485 (18)
					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2112 (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	0.2693	0.2640	0.2588	0.2323	0.2271	0.2007	0.2007	0.1954	0.2112	0.2271	0.2376	0.2482 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5193	0.5140	0.5088	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			6.5400	1.3258	8.6705		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
150mm EPS B&B			50.6800	0.1700	8.6156	75.0000	3801.0000 (28a)
140mm Timber Frame	44.1500	10.7800	33.3700	0.1900	6.3403	9.0000	300.3300 (29a)
WTS	15.8900		15.8900	0.1500	2.3835	18.0000	286.0200 (29a)
Total net area of external elements Aum(A, m ²)			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 31.5765		(33)
Timber Frame			15.8900	0.0000	0.0000	20.0000	317.8000 (32)
Party Ceilings			50.6800			30.0000	1520.4000 (32b)
Timber			113.4100			9.0000	1020.6900 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7246.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							142.9803 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5561 (36)
Total fabric heat loss							(33) + (36) = 43.1325 (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	21.8867	21.6641	21.4415	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727 (38)
Heat transfer coeff	65.0192	64.7966	64.5741	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053 (39)
Average = Sum(39)m / 12 =												64.3531 (39)
HLP	1.2829	1.2785	1.2742	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669 (40)
HLP (average)												1.2698 (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												1.7101 (42)
Average daily hot water use (litres/day)												74.8157 (43)
Daily hot water use	82.2973	79.3047	76.3120	73.3194	70.3268	67.3341	67.3341	70.3268	73.3194	76.3120	79.3047	82.2973 (44)
Energy conte	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1177.1425 (45)										
Distribution loss (46)m = 0.15 x (45)m											
18.3067	16.0111	16.5221	14.4043	13.8213	11.9267	11.0519	12.6822	12.8336	14.9564	16.3261	17.7290 (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	14.5182	13.0950	14.4691	13.9695	14.4113	13.9189	14.3657	14.3953	13.9465	14.4452	14.0172 (61)
Total heat required for water heating calculated for each month											
136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023 (64)
Heat gains from water heating, kWh/month											
44.2094	38.7651	40.2412	35.4220	34.2400	29.9173	28.0897	31.7110	31.9345	36.7646	39.6937	42.9265 (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	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.2186	30.3927	24.7170	18.7123	13.9877	11.8090	12.7600	16.5860	22.2617	28.2663	32.9910	35.1697	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.3879	224.6956	218.8803	206.5002	190.8726	176.1848	166.3724	164.0647	169.8800	182.2601	197.8878	212.5756	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	(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)	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)	59.4212	57.6862	54.0876	49.1972	46.0216	41.5518	37.7550	42.6223	44.3535	49.4148	55.1302	57.6970	(72)
Total internal gains	400.2014	396.9481	381.8585	358.5834	335.0555	313.7193	301.0612	307.4467	320.6689	344.1149	370.1826	389.6159	(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					2.1600	10.6334	0.7200	0.7000	0.7700		8.0221 (74)	
South					4.3800	46.7521	0.7200	0.7000	0.7700		71.5218 (78)	
South					2.1200	46.7521	0.7200	0.7000	0.7700		34.6179 (78)	
Solar gains	114.1618	189.1602	247.4785	292.1056	317.1557	311.3163	301.5541	282.8358	262.6289	205.7406	135.7081	98.4021 (83)
Total gains	514.3632	586.1083	629.3371	650.6890	652.2112	625.0355	602.6152	590.2824	583.2978	549.8555	505.8907	488.0180 (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	30.9577	31.0640	31.1711	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501
alpha	3.0638	3.0709	3.0781	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900
util living area	0.9440	0.9175	0.8797	0.8178	0.7212	0.5823	0.4437	0.4691	0.6439	0.8233	0.9169	0.9509 (86)
MIT	19.3780	19.6326	19.9635	20.3359	20.6561	20.8726	20.9590	20.9499	20.8170	20.4164	19.8369	19.3321 (87)
Th 2	19.8542	19.8577	19.8611	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669 (88)
util rest of house	0.9338	0.9032	0.8584	0.7845	0.6679	0.5005	0.3392	0.3653	0.5673	0.7844	0.8999	0.9419 (89)
MIT 2	17.7527	18.1148	18.5817	19.0970	19.5142	19.7663	19.8457	19.8393	19.7105	19.2164	18.4184	17.6958 (90)
Living area fraction	18.4198	18.7377	19.1488	19.6055	19.9829	20.2203	20.3026	20.2951	20.1647	19.7089	19.0006	18.3674 (92)
MIT	18.4198	18.7377	19.1488	19.6055	19.9829	20.2203	20.3026	20.2951	20.1647	19.7089	19.0006	18.3674 (91)
Temperature adjustment	18.2698	18.5877	18.9988	19.4555	19.8329	20.0703	20.1526	20.1451	20.0147	19.5589	18.8506	-0.1500
adjusted MIT	18.2698	18.5877	18.9988	19.4555	19.8329	20.0703	20.1526	20.1451	20.0147	19.5589	18.8506	18.2174 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9157	0.8834	0.8393	0.7707	0.6662	0.5161	0.3666	0.3919	0.5781	0.7723	0.8810	0.9248	0.9248	(94)
Useful gains	470.9945	517.7408	528.2263	501.4542	434.4909	322.5928	220.9186	231.3398	337.2183	424.6283	445.6722	451.3060	(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	908.3033	886.9196	807.0978	677.7171	522.1732	351.2230	228.0976	240.4562	379.7528	575.2095	754.4481	899.9902	(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	325.3578	248.0882	207.4805	126.9093	65.2356	0.0000	0.0000	0.0000	0.0000	112.0325	222.3186	333.8211	(98)
Space heating												1641.2433	(98)
Space heating per m2												32.3844	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1813.5286 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	325.3578	248.0882	207.4805	126.9093	65.2356	0.0000	0.0000	0.0000	0.0000	112.0325	222.3186	333.8211	(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)	359.5113	274.1306	229.2602	140.2312	72.0835	0.0000	0.0000	0.0000	0.0000	123.7928	245.6559	368.8631	(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	136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023	(64)
Efficiency of water heater (217)m	89.5298	89.4323	89.2721	88.9855	88.4882	87.3000	87.3000	87.3000	87.3000	88.8562	89.3345	87.3000	(216)
Fuel for water heating, kWh/month	152.5333	133.9963	139.5913	123.6138	120.4153	107.0223	100.8532	113.3369	113.9795	128.4709	137.5254	148.1612	(219)
Water heating fuel used												1519.4995	(219)
Annual totals kWh/year													
Space heating fuel - main system												1813.5286	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)													
mechanical ventilation fans (SFP = 0.2260)													35.2058 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													110.2058 (231)
Electricity for lighting (calculated in Appendix L)													241.7246 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3684.9584 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1813.5286	3.4800	63.1108 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1519.4995	3.4800	52.8786 (247)
Mechanical ventilation fans	35.2058	13.1900	4.6436 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	241.7246	13.1900	31.8835 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			282.4090 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2397 (257)
SAP value		82.7066
SAP rating (Section 12)		83 (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	1813.5286	0.2160	391.7222 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1519.4995	0.2160	328.2119 (264)
Space and water heating			719.9341 (265)
Pumps and fans	110.2058	0.5190	57.1968 (267)
Energy for lighting	241.7246	0.5190	125.4550 (268)
Energy saving/generation technologies			
PV Unit	-432.0800	0.5190	-224.2495 (269)
Total kg/year			678.3364 (272)
CO2 emissions per m2			13.3800 (273)
EI value			90.4999
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8856 = 3.930$, stars = 4
Water heating environmental impact	$0.216 / 0.8856 = 0.2439$, 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	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (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)			
									Air changes per hour			
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000	(8)			
Pressure test							Yes					
Measured/design AP50							4.9700					
Infiltration rate							0.2485	(18)				
Number of sides sheltered							2	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.8500	(20)			
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.2112	(21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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												
	0.2323	0.2165	0.2165	0.2059	0.2059	0.1954	0.1954	0.1848	0.1848	0.2007	0.1954	0.2059 (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)			6.5400	1.3258	8.6705		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
150mm EPS B&B			50.6800	0.1700	8.6156	75.0000	3801.0000 (28a)
140mm Timber Frame	44.1500	10.7800	33.3700	0.1900	6.3403	9.0000	300.3300 (29a)
WTS	15.8900		15.8900	0.1500	2.3835	18.0000	286.0200 (29a)
Total net area of external elements Aum(A, m2)			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.5765		(33)
Timebr Frame			15.8900	0.0000	0.0000	20.0000	317.8000 (32)
Party Ceilings			50.6800			30.0000	1520.4000 (32b)
Timber			113.4100			9.0000	1020.6900 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7246.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							142.9803 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5561 (36)
Total fabric heat loss					(33) + (36) =		43.1325 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 21.0727	Feb 21.0727	Mar 21.0727	Apr 21.0727	May 21.0727	Jun 21.0727	Jul 21.0727	Aug 21.0727	Sep 21.0727	Oct 21.0727	Nov 21.0727	Dec 21.0727 (38)
Heat transfer coeff	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053	64.2053 (39)
Average = Sum(39)m / 12 =												64.2053 (39)
HLP	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669	1.2669 (40)
HLP (average)												1.2669 (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												1.7101 (42)
Average daily hot water use (litres/day)												74.8157 (43)
Daily hot water use	Jan 82.2973	Feb 79.3047	Mar 76.3120	Apr 73.3194	May 70.3268	Jun 67.3341	Jul 67.3341	Aug 70.3268	Sep 73.3194	Oct 76.3120	Nov 79.3047	Dec 82.2973 (44)
Energy conte	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	Total = Sum(45)m = 1177.1425 (45)										
Distribution loss (46)m = 0.15 x (45)m											
18.3067	16.0111	16.5221	14.4043	13.8213	11.9267	11.0519	12.6822	12.8336	14.9564	16.3261	17.7290 (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	14.5182	13.0950	14.4691	13.9695	14.4113	13.9189	14.3657	14.3953	13.9465	14.4452	14.0172 (61)
Total heat required for water heating calculated for each month											
136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023 (64)
Heat gains from water heating, kWh/month											
44.2094	38.7651	40.2412	35.4220	34.2400	29.9173	28.0897	31.7110	31.9345	36.7646	39.6937	42.9265 (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	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.2186	30.3927	24.7170	18.7123	13.9877	11.8090	12.7600	16.5860	22.2617	28.2663	32.9910	35.1697	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.3879	224.6956	218.8803	206.5002	190.8726	176.1848	166.3724	164.0647	169.8800	182.2601	197.8878	212.5756	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	(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)	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)	59.4212	57.6862	54.0876	49.1972	46.0216	41.5518	37.7550	42.6223	44.3535	49.4148	55.1302	57.6970	(72)
Total internal gains	400.2014	396.9481	381.8585	358.5834	335.0555	313.7193	301.0612	307.4467	320.6689	344.1149	370.1826	389.6159	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1600	13.4839	0.7200	0.7000	0.7700	10.1726	(74)
South	4.3800	56.7559	0.7200	0.7000	0.7700	86.8258	(78)
South	2.1200	56.7559	0.7200	0.7000	0.7700	42.0253	(78)

Solar gains	139.0236	195.7098	258.3440	309.0345	320.2642	346.3037	322.9575	313.5378	288.0248	226.6971	164.6192	113.5152	(83)
Total gains	539.2250	592.6579	640.2025	667.6179	655.3197	660.0229	624.0187	620.9845	608.6937	570.8120	534.8018	503.1311	(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	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501	31.3501
alpha	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900	3.0900
util living area	0.9260	0.9020	0.8536	0.7763	0.6519	0.4657	0.3315	0.3330	0.5444	0.7601	0.8844	0.9360 (86)
MIT	19.6370	19.8197	20.1483	20.4899	20.7829	20.9456	20.9863	20.9862	20.9061	20.6093	20.0882	19.5773 (87)
Th 2	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669	19.8669 (88)
util rest of house	0.9124	0.8845	0.8274	0.7353	0.5859	0.3731	0.2213	0.2223	0.4542	0.7075	0.8603	0.9238 (89)
MIT 2	18.1305	18.3861	18.8418	19.3002	19.6660	19.8334	19.8627	19.8626	19.8003	19.4645	18.7693	18.0479 (90)
Living area fraction	18.7488	18.9744	19.3780	19.7885	20.1244	20.2899	20.3239	20.3238	20.2541	19.9344	19.3106	18.6756 (91)
MIT	18.7488	18.9744	19.3780	19.7885	20.1244	20.2899	20.3239	20.3238	20.2541	19.9344	19.3106	18.6756 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5988	18.8244	19.2280	19.6385	19.9744	20.1399	20.1739	20.1738	20.1041	19.7844	19.1606	18.5256 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8932	0.8649	0.8101	0.7261	0.5926	0.3963	0.2518	0.2529	0.4741	0.7032	0.8423	0.9053	(94)
Ext temp.	481.6533	512.5799	518.6542	484.7768	388.3573	261.5749	157.1025	157.0725	288.5955	401.4155	450.4383	455.4739	(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)
847.4299	829.8177	746.5794	618.8403	441.3744	272.2213	158.8354	158.8285	308.4497	499.7967	690.8882	836.3113	836.3113	(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	272.1378	213.1838	169.5763	96.5257	39.4447	0.0000	0.0000	0.0000	0.0000	73.1956	173.1239	283.3430	(98)
Space heating												1320.5309	(98)
Space heating per m2												26.0563	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1459.1501 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	272.1378	213.1838	169.5763	96.5257	39.4447	0.0000	0.0000	0.0000	0.0000	73.1956	173.1239	283.3430	(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)	300.7047	235.5622	187.3772	106.6583	43.5853	0.0000	0.0000	0.0000	0.0000	80.8791	191.2971	313.0862	(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	136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023	(64)
Efficiency of water heater (217)m	89.4050	89.3218	89.1163	88.7670	88.1420	87.3000	87.3000	87.3000	87.3000	88.5229	89.1437	87.3000	(216)
Fuel for water heating, kWh/month	152.7462	134.1620	139.8354	123.9181	120.8882	107.0223	100.8532	113.3369	113.9795	128.9546	137.8198	148.3467	(219)
Water heating fuel used	152.7462	134.1620	139.8354	123.9181	120.8882	107.0223	100.8532	113.3369	113.9795	128.9546	137.8198	1521.8629	(219)
Annual totals kWh/year													
Space heating fuel - main system												1459.1501	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)													
mechanical ventilation fans (SFP = 0.2260)													35.2058 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													110.2058 (231)
Electricity for lighting (calculated in Appendix L)													241.7246 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3332.9434 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1459.1501	10.2300	149.2711	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1521.8629	10.2300	155.6866	(247)
Mechanical ventilation fans	35.2058	36.7200	12.9276	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	241.7246	36.7200	88.7613	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	36.7200	0.0000	(252)
Total energy cost			537.1865	(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	1459.1501	0.2160	315.1764	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1521.8629	0.2160	328.7224	(264)
Space and water heating			643.8988	(265)
Pumps and fans	110.2058	0.5190	57.1968	(267)
Energy for lighting	241.7246	0.5190	125.4550	(268)
Energy saving/generation technologies				
PV Unit	-432.0800	0.5190	-224.2495	(269)
Total kg/year			602.3011	(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	1459.1501	1.2200	1780.1632	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1521.8629	1.2200	1856.6728	(264)
Space and water heating			3636.8359	(265)
Pumps and fans	110.2058	3.0700	338.3317	(267)
Energy for lighting	241.7246	3.0700	742.0944	(268)
Energy saving/generation technologies				
PV Unit	-432.0800	3.0700	-1326.4856	(269)
Primary energy kWh/year			3390.7764	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Primary energy kWh/m²/year

66.9056 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
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	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
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: (none) SAP change Cost change CO2 change

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m ²	

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 524 TEST (01 Aug 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£129	£129	£0
Mains gas	£408	£408	£0
Space heating	£293	£293	£0
Water heating	£156	£156	£0
Lighting	£89	£89	£0
Total cost of fuels	£537	£537	£0
Total cost of uses	£538	£538	£0
Delivered energy	66 kWh/m ²	66 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m ²	12 kg/m ²	12 kg/m ²	0 kg/m ²
Primary energy	67 kWh/m ²	67 kWh/m ²	0 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

No improvements selected / applicable

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	143.0 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	126.44 (P1)
Transmission heat loss coefficient	43.13 (37)
Summer heat loss coefficient	169.57 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.1600	87.1704	0.7200	0.7000	0.9000	76.8668
South	4.3800	118.5567	0.7200	0.7000	0.9000	211.9901
South	2.1200	118.5567	0.7200	0.7000	0.9000	102.6071
total:						391.4640

	Jun	Jul	Aug	
Solar gains	415	391	372	(P3)
Internal gains	311	298	304	
Total summer gains	726	690	676	(P5)

Summer gain/loss ratio	4.28	4.07	3.99	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 143.0)	1.00	1.00	1.00	
Threshold temperature	20.68	22.37	22.29	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	

Assessment of likelihood of high internal temperature: Medium