

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-214			Issued on Date	08/09/2023
Assessment Reference	As Built	Prop Type Ref	GF Flat Det		
Property	50, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	82 B	DER	15.49	TER	21.33
Environmental	89 B	% DER<TER	27.38		
CO ₂ Emissions (t/year)	0.74	DFEE	53.67	TFEE	59.58
General Requirements Compliance	Pass	% DFEE<TFEE	9.92		
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk			Assessor ID	T510-0001
Client	Drew Smith				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Ground-floor flat, total floor area 61 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) 21.33 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.49 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.24 (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: 4.93 (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): Slight OK
Based on:
Overshading:
Average
Windows facing North: 3.06 m², No overhang
Windows facing West: 5.21 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 519.90 kWh/Year

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (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							4.9300					
Infiltration rate							0.2465	(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) =	0.2095 (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)
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												
	0.2671	0.2619	0.2567	0.2305	0.2252	0.1990	0.1990	0.1938	0.2095	0.2252	0.2357	0.2462 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5171	0.5119	0.5067	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
Window (Uw = 1.40)			6.1500	1.3258	8.1534		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
150mm EPS B&B			60.9800	0.1800	10.9764	75.0000	4573.5000 (28a)
140mm Timber Frame	45.1600	8.2700	36.8900	0.1900	7.0091	9.0000	332.0100 (29a)
WTS	37.2100	2.1200	35.0900	0.1500	5.2635	18.0000	631.6200 (29a)
Total net area of external elements Aum(A, m ²)			143.3500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			35.5486	(33)
Party Ceilings			60.9800			30.0000	1829.4000 (32b)
Timber			122.1200			9.0000	1099.0800 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		8465.6100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.8260 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.8491 (36)
Total fabric heat loss					(33) + (36) =		50.3977 (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	26.2249	25.9593	25.6936	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555 (38)
Heat transfer coeff	76.6226	76.3570	76.0913	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532 (39)
Average = Sum(39)m / 12 =												75.9041 (39)
HLP	1.2565	1.2522	1.2478	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423 (40)
HLP (average)												1.2447 (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												2.0092 (42)
Average daily hot water use (litres/day)												81.9186 (43)
Daily hot water use	Jan 90.1104	Feb 86.8337	Mar 83.5569	Apr 80.2802	May 77.0035	Jun 73.7267	Jul 73.7267	Aug 77.0035	Sep 80.2802	Oct 83.5569	Nov 86.8337	Dec 90.1104 (44)
Energy conte	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Energy content (annual)												Total = Sum(45)m = 1288.8982 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	20.0447	17.5312	18.0906	15.7718	15.1335	13.0590	12.1011	13.8862	14.0520	16.3763	17.8760	19.4122 (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	14.5782	13.1455	14.5192	14.0115	14.4500	13.9509	14.3953	14.4308	13.9839	14.4906	14.0687	14.5668 (61)
Total heat required for water heating calculated for each month	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (64)
Heat gains from water heating, kWh/month	48.0769	42.1472	43.7307	38.4638	37.1583	32.4352	30.4230	34.3888	34.6447	39.9235	43.1424	46.6721 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1459.4896 (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	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.8939	15.0050	12.2029	9.2384	6.9058	5.8302	6.2997	8.1886	10.9907	13.9552	16.2878	17.3634 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4116	177.2318	172.6449	162.8799	150.5534	138.9682	131.2286	129.4084	133.9953	143.7602	156.0868	167.6720 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460 (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)	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681 (71)
Water heating gains (Table 5)	64.6195	62.7191	58.7778	53.4220	49.9440	45.0489	40.8911	46.2215	48.1176	53.6606	59.9199	62.7313 (72)
Total internal gains	313.0630	311.0939	299.7636	281.6783	263.5412	245.9853	234.5574	239.9564	249.2416	267.5140	288.4325	303.9047 (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				3.0600	10.6334	0.7200	0.7000	0.7700	11.3647 (74)			
West				3.0900	19.6403	0.7200	0.7000	0.7700	21.1968 (80)			
West				2.1200	19.6403	0.7200	0.7000	0.7700	14.5428 (80)			
Solar gains	47.1042	91.6326	152.0436	227.2016	285.6497	296.1546	280.3772	235.6032	178.2827	108.8120	58.5828	38.8646 (83)
Total gains	360.1672	402.7265	451.8072	508.8799	549.1909	542.1399	514.9346	475.5596	427.5243	376.3260	347.0153	342.7693 (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	30.6901	30.7969	30.9044	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424
alpha	3.0460	3.0531	3.0603	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695
util living area	0.9848	0.9775	0.9605	0.9196	0.8389	0.7106	0.5749	0.6277	0.8241	0.9431	0.9775	0.9869 (86)
MIT	18.8671	19.0705	19.4528	19.9614	20.4356	20.7695	20.9137	20.8844	20.6056	19.9978	19.3476	18.8369 (87)
Th 2	19.8750	19.8785	19.8819	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863 (88)
util rest of house	0.9817	0.9728	0.9520	0.9008	0.7980	0.6311	0.4552	0.5107	0.7636	0.9260	0.9721	0.9842 (89)
MIT 2	17.0385	17.3358	17.8907	18.6186	19.2696	19.6887	19.8369	19.8143	19.5070	18.6827	17.7458	17.0011 (90)
Living area fraction	17.7369	17.9984	18.4873	19.1314	19.7149	20.1015	20.2482	20.2230	19.9266	19.1850	18.3576	17.7022 (91)
MIT	17.7369	17.9984	18.4873	19.1314	19.7149	20.1015	20.2482	20.2230	19.9266	19.1850	18.3576	17.7022 (92)
Temperature adjustment	17.5869	17.8484	18.3373	18.9814	19.5649	19.9515	20.0982	20.0730	19.7766	19.0350	18.2076	17.5522 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9723	0.9608	0.9358	0.8813	0.7841	0.6363	0.4798	0.5323	0.7565	0.9084	0.9602	0.9758 (94)
Ext temp.	350.1940	386.9325	422.7828	448.4638	430.6062	344.9846	247.0566	253.1284	323.4048	341.8709	333.1907	334.4877 (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	1018.0753	988.6969	900.7152	763.7020	595.7943	405.3924	264.9976	278.2404	430.0197	638.9748	841.4367	1011.4723 (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	496.9037	404.3857	355.5817	226.9715	122.8999	0.0000	0.0000	0.0000	0.0000	221.0453	365.9371	503.6765 (98)
Space heating per m2												2697.4013 (98)
												(98) / (4) = 44.2342 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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												2980.5539 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	496.9037	404.3857	355.5817	226.9715	122.8999	0.0000	0.0000	0.0000	0.0000	221.0453	365.9371	503.6765 (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)	549.0648	446.8351	392.9079	250.7972	135.8010	0.0000	0.0000	0.0000	0.0000	244.2489	404.3504	556.5486 (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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (64)
Efficiency of water heater (217)m	89.7442	89.7000	89.5957	89.3722	88.9220	87.3000	87.3000	87.3000	87.3000	89.3254	89.6231	87.3000 (216)
Fuel for water heating, kWh/month	165.1463	144.9500	150.8147	133.3269	129.7089	115.7057	108.8997	122.5721	123.3267	138.4444	148.6695	160.3919 (219)
Water heating fuel used												1641.9567 (219)
Annual totals kWh/year												
Space heating fuel - main system												2980.5539 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)												
mechanical ventilation fans (SFP = 0.2260)												42.3609 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												117.3609 (231)
Electricity for lighting (calculated in Appendix L)												298.3509 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												5038.2224 (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	2980.5539	0.2160	643.7997 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1641.9567	0.2160	354.6627 (264)
Space and water heating			998.4623 (265)
Pumps and fans	117.3609	0.5190	60.9103 (267)
Energy for lighting	298.3509	0.5190	154.8441 (268)
Energy saving/generation technologies			
PV Unit	-519.9000	0.5190	-269.8281 (269)
Total CO2, kg/year			944.3886 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.4900 (273)

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

DER		15.4900 ZC1
Total Floor Area	TFA	60.9800
Assumed number of occupants	N	2.0092
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.0458 ZC2
CO2 emissions from cooking, equation (L16)		2.7422 ZC3
Total CO2 emissions		35.2780 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		35.2780 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (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) = 0.1301 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3801 (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) =				0.3231 (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	0.4120	0.4039	0.3958	0.3554	0.3474	0.3070	0.3070	0.2989	0.3231	0.3474	0.3635	0.3797 (22b)
	0.5849	0.5816	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721 (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)			8.2700	1.3258	10.9640		(27)
150mm EPS B&B			60.9800	0.1300	7.9274		(28a)
140mm Timber Frame	45.1600	8.2700	36.8900	0.1800	6.6402		(29a)
WTS	37.2100	2.1200	35.0900	0.1800	6.3162		(29a)
Total net area of external elements Aum, m ²			143.3500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.9678		(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)							10.9806 (36)
Total fabric heat loss						(33) + (36) =	44.9484 (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	29.6592	29.4920	29.3282	28.5588	28.4149	27.7448	27.7448	27.6207	28.0029	28.4149	28.7061	29.0105 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	74.6076	74.4404	74.2766	73.5072	73.3633	72.6932	72.6932	72.5691	72.9513	73.3633	73.6545	73.9590 (39)
												73.5066 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2235	1.2207	1.2180	1.2054	1.2031	1.1921	1.1921	1.1900	1.1963	1.2031	1.2078	1.2128 (40)
HLP (average)												1.2054 (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												2.0092 (42)
Average daily hot water use (litres/day)												81.9186 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1104	86.8337	83.5569	80.2802	77.0035	73.7267	73.7267	77.0035	80.2802	83.5569	86.8337	90.1104 (44)
Energy conte	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Energy content (annual)												Total = Sum(45)m = 1288.8982 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0447	17.5312	18.0906	15.7718	15.1335	13.0590	12.1011	13.8862	14.0520	16.3763	17.8760	19.4122 (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 EMISSIONS 09 Jan 2014

Combi loss	45.9193	39.9673	42.5797	39.5902	39.2401	36.3584	37.5703	39.2401	39.5902	42.5797	42.8221	45.9193 (61)
Total heat required for water heating calculated for each month	179.5505	156.8420	163.1839	144.7359	140.1299	123.4186	118.2444	131.8148	133.2705	151.7551	161.9955	175.3339 (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	179.5505	156.8420	163.1839	144.7359	140.1299	123.4186	118.2444	131.8148	133.2705	151.7551	161.9955	175.3339 (64)
Heat gains from water heating, kWh/month	55.9122	48.8527	50.7458	44.8585	43.3559	38.0371	36.2167	40.5911	41.0463	46.9457	50.3307	54.5102 (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	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.8939	15.0050	12.2029	9.2384	6.9058	5.8302	6.2997	8.1886	10.9907	13.9552	16.2878	17.3634 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4116	177.2318	172.6449	162.8799	150.5534	138.9682	131.2286	129.4084	133.9953	143.7602	156.0868	167.6720 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460 (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)	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681 (71)
Water heating gains (Table 5)	75.1508	72.6974	68.2067	62.3035	58.2740	52.8293	48.6784	54.5579	57.0087	63.0991	69.9037	73.2664 (72)
Total internal gains	323.5943	321.0722	309.1926	290.5598	271.8713	253.7657	242.3447	248.2929	258.1327	276.9526	298.4163	314.4398 (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					3.0600	10.6334	0.6300	0.7000	0.7700		9.9441 (74)	
West					5.2100	19.6403	0.6300	0.7000	0.7700		31.2721 (80)	
Solar gains	41.2162	80.1785	133.0381	198.8014	249.9435	259.1353	245.3300	206.1528	155.9973	95.2105	51.2599	34.0065 (83)
Total gains	364.8105	401.2507	442.2307	489.3612	521.8147	512.9010	487.6747	454.4457	414.1300	372.1631	349.6762	348.4463 (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	56.7600	56.8874	57.0128	57.6096	57.7226	58.2547	58.2547	58.3544	58.0486	57.7226	57.4944	57.2577
alpha	4.7840	4.7925	4.8009	4.8406	4.8482	4.8836	4.8836	4.8903	4.8699	4.8482	4.8330	4.8172
util living area	0.9980	0.9965	0.9917	0.9743	0.9190	0.7872	0.6245	0.6831	0.8995	0.9840	0.9963	0.9984 (86)
MIT	19.6598	19.7856	20.0288	20.3708	20.6908	20.9060	20.9766	20.9642	20.8001	20.3948	19.9706	19.6378 (87)
Th 2	19.9013	19.9034	19.9056	19.9157	19.9175	19.9263	19.9263	19.9280	19.9229	19.9175	19.9137	19.9097 (88)
util rest of house	0.9973	0.9952	0.9886	0.9635	0.8829	0.6969	0.4876	0.5480	0.8400	0.9754	0.9948	0.9979 (89)
MIT 2	18.1202	18.3055	18.6611	19.1603	19.6000	19.8598	19.9173	19.9123	19.7509	19.2014	18.5835	18.0940 (90)
Living area fraction									fLA = Living area / (4) =			0.3819 (91)
MIT	18.7082	18.8708	19.1835	19.6226	20.0166	20.2594	20.3219	20.3141	20.1516	19.6572	19.1133	18.6836 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7082	18.8708	19.1835	19.6226	20.0166	20.2594	20.3219	20.3141	20.1516	19.6572	19.1133	18.6836 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9962	0.9936	0.9858	0.9598	0.8868	0.7277	0.5404	0.5999	0.8550	0.9726	0.9932	0.9970 (94)
Useful gains	363.4376	398.6731	435.9351	469.6778	462.7540	373.2397	263.5574	272.6263	354.0933	361.9650	347.2852	347.3934 (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	1074.9620	1039.9934	942.0856	788.1924	610.1311	411.3984	270.5559	284.0397	441.4745	664.4637	884.8325	1071.1927 (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	529.3742	430.9672	376.5760	229.3305	109.6486	0.0000	0.0000	0.0000	0.0000	225.0590	387.0341	538.5067 (98)
Space heating												2826.4963 (98)
Space heating per m2										(98) / (4) =		46.3512 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													3026.2273 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	529.3742	430.9672	376.5760	229.3305	109.6486	0.0000	0.0000	0.0000	0.0000	225.0590	387.0341	538.5067	(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)	566.7818	461.4210	403.1863	245.5359	117.3968	0.0000	0.0000	0.0000	0.0000	240.9625	414.3834	576.5596	(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	179.5505	156.8420	163.1839	144.7359	140.1299	123.4186	118.2444	131.8148	133.2705	151.7551	161.9955	175.3339	(64)
Efficiency of water heater	87.6091	87.4646	87.0884	86.2047	84.4415	80.3000	80.3000	80.3000	80.3000	86.0416	87.1651	87.6909	(216)
(217)m	87.6091	87.4646	87.0884	86.2047	84.4415	80.3000	80.3000	80.3000	80.3000	86.0416	87.1651	87.6909	(217)
Fuel for water heating, kWh/month	204.9449	179.3205	187.3774	167.8979	165.9491	153.6969	147.2533	164.1529	165.9658	176.3741	185.8490	199.9454	(219)
Water heating fuel used												2098.7273	(219)
Annual totals kWh/year													
Space heating fuel - main system												3026.2273	(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)												298.3509	(232)
Total delivered energy for all uses												5498.3054	(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	3026.2273	0.2160	653.6651 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2098.7273	0.2160	453.3251 (264)
Space and water heating			1106.9902 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	298.3509	0.5190	154.8441 (268)
Total CO2, kg/m2/year			1300.7593 (272)
Emissions per m2 for space and water heating			18.1533 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5393 (272b)
Emissions per m2 for pumps and fans			0.6383 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.1533 * 1.00) + 2.5393 + 0.6383, rounded to 2 d.p.			21.3300 (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	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (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) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1301 (8)
Measured/design AP50					Yes
Infiltration rate					4.9300
Number of sides sheltered					0.3766 (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) =				0.3202 (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												
	0.4082	0.4002	0.3922	0.3522	0.3442	0.3041	0.3041	0.2961	0.3202	0.3442	0.3602	0.3762 (22b)
Effective ac	0.5833	0.5801	0.5769	0.5620	0.5592	0.5463	0.5463	0.5438	0.5512	0.5592	0.5649	0.5708 (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
Window (Uw = 1.40)			6.1500	1.3258	8.1534		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
150mm EPS B&B			60.9800	0.1800	10.9764	75.0000	4573.5000 (28a)
140mm Timber Frame	45.1600	8.2700	36.8900	0.1900	7.0091	9.0000	332.0100 (29a)
WTS	37.2100	2.1200	35.0900	0.1500	5.2635	18.0000	631.6200 (29a)
Total net area of external elements Aum(A, m ²)			143.3500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.5486		(33)
Party Ceilings			60.9800			20.0000	1219.6000 (32b)
Timber			122.1200			9.0000	1099.0800 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7855.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							128.8260 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.8491 (36)
Total fabric heat loss						(33) + (36) =	50.3977 (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	29.5803	29.4162	29.2554	28.5001	28.3588	27.7010	27.7010	27.5791	27.9544	28.3588	28.6447	28.9435 (38)
Heat transfer coeff	79.9780	79.8139	79.6531	78.8978	78.7565	78.0987	78.0987	77.9769	78.3521	78.7565	79.0424	79.3413 (39)
Average = Sum(39)m / 12 =												78.8972 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3115	1.3089	1.3062	1.2938	1.2915	1.2807	1.2807	1.2787	1.2849	1.2915	1.2962	1.3011 (40)
HLP (average)												1.2938 (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	2.0092 (42)
Average daily hot water use (litres/day)	81.9186 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1104	86.8337	83.5569	80.2802	77.0035	73.7267	73.7267	77.0035	80.2802	83.5569	86.8337	90.1104 (44)
Energy conte	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Energy content (annual)										Total = Sum(45)m =		1288.8982 (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:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	28.3966	24.8359	25.6284	22.3435	21.4391	18.5003	17.1432	19.6721	19.9071	23.1998	25.3244	27.5006 (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	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.8939	15.0050	12.2029	9.2384	6.9058	5.8302	6.2997	8.1886	10.9907	13.9552	16.2878	17.3634	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4116	177.2318	172.6449	162.8799	150.5534	138.9682	131.2286	129.4084	133.9953	143.7602	156.0868	167.6720	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	(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)	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	(71)
Water heating gains (Table 5)	38.1675	36.9581	34.4468	31.0326	28.8160	25.6948	23.0420	26.4410	27.6487	31.1825	35.1727	36.9632	(72)
Total internal gains	283.6110	282.3330	272.4326	256.2889	239.4132	223.6312	213.7083	217.1760	225.7727	242.0359	260.6853	275.1366	(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	3.0600	10.6334	0.7200	0.7000	0.7700	11.3647 (74)
West	3.0900	19.6403	0.7200	0.7000	0.7700	21.1968 (80)
West	2.1200	19.6403	0.7200	0.7000	0.7700	14.5428 (80)

Solar gains	47.1042	91.6326	152.0436	227.2016	285.6497	296.1546	280.3772	235.6032	178.2827	108.8120	58.5828	38.8646	(83)
Total gains	330.7152	373.9655	424.4761	483.4905	525.0629	519.7858	494.0855	452.7791	404.0554	350.8479	319.2681	314.0012	(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	27.2846	27.3407	27.3959	27.6582	27.7078	27.9412	27.9412	27.9848	27.8508	27.7078	27.6076	27.5036	
alpha	2.8190	2.8227	2.8264	2.8439	2.8472	2.8627	2.8627	2.8657	2.8567	2.8472	2.8405	2.8336	
util living area	0.9852	0.9781	0.9618	0.9231	0.8480	0.7264	0.5962	0.6499	0.8370	0.9468	0.9786	0.9872	(86)
MIT	18.5935	18.8076	19.2178	19.7824	20.3117	20.7061	20.8820	20.8451	20.5139	19.8331	19.1181	18.5550	(87)
Th 2	19.8318	19.8339	19.8360	19.8457	19.8475	19.8560	19.8560	19.8575	19.8527	19.8475	19.8438	19.8400	(88)
util rest of house	0.9823	0.9737	0.9537	0.9052	0.8091	0.6485	0.4743	0.5324	0.7797	0.9311	0.9736	0.9847	(89)
MIT 2	17.6456	17.8596	18.2669	18.8256	19.3278	19.6795	19.8080	19.7889	19.5269	18.8849	18.1768	17.6131	(90)
Living area fraction									fLA = Living area / (4) =			0.3819	(91)
MIT	18.0077	18.2217	18.6301	19.1910	19.7036	20.0716	20.2182	20.1923	19.9039	19.2470	18.5363	17.9728	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0077	18.2217	18.6301	19.1910	19.7036	20.0716	20.2182	20.1923	19.9039	19.2470	18.5363	17.9728	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9759	0.9654	0.9427	0.8928	0.8034	0.6648	0.5160	0.5703	0.7827	0.9204	0.9657	0.9790	(94)
Ext temp.	322.7574	361.0324	400.1533	431.6429	421.8365	345.5755	254.9521	258.2295	316.2730	322.9319	308.3259	307.4120	(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	1096.3105	1063.2559	966.1971	811.9389	630.3333	427.3250	282.5754	295.7100	454.7458	681.0113	903.9539	1092.7520	(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	575.5235	471.8942	421.1366	273.8131	155.1216	0.0000	0.0000	0.0000	0.0000	266.4110	428.8521	584.2930	(98)
Space heating per m2												3177.0452	(98)
												52.0998	(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	734.1276	577.9302	592.6241	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7139	0.7838	0.7487	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	524.0584	452.9734	443.7177	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	683.0887	651.6168	604.6880	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	114.5018	147.7907	119.7620	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												382.0545 (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	28.6255	36.9477	29.9405	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												95.5136 (107)
Space cooling per m2												1.5663 (108)
Energy for space heating												52.0998 (99)
Energy for space cooling												1.5663 (108)
Total												53.6661 (109)
Dwelling Fabric Energy Efficiency (DFEE)												53.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (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) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1301 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3801 (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) =	0.3231 (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	0.4120	0.4039	0.3958	0.3554	0.3474	0.3070	0.3070	0.2989	0.3231	0.3474	0.3635	0.3797 (22b)
	0.5849	0.5816	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721 (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)			8.2700	1.3258	10.9640		(27)
150mm EPS B&B			60.9800	0.1300	7.9274		(28a)
140mm Timber Frame	45.1600	8.2700	36.8900	0.1800	6.6402		(29a)
WTS	37.2100	2.1200	35.0900	0.1800	6.3162		(29a)
Total net area of external elements Aum, m ²			143.3500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.9678		(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)							10.9806 (36)
Total fabric heat loss						(33) + (36) =	44.9484 (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	29.6592	29.4920	29.3282	28.5588	28.4149	27.7448	27.7448	27.6207	28.0029	28.4149	28.7061	29.0105 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	74.6076	74.4404	74.2766	73.5072	73.3633	72.6932	72.6932	72.5691	72.9513	73.3633	73.6545	73.9590 (39)
												73.5066 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2235	1.2207	1.2180	1.2054	1.2031	1.1921	1.1921	1.1900	1.1963	1.2031	1.2078	1.2128 (40)
HLP (average)												1.2054 (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												2.0092 (42)
Average daily hot water use (litres/day)												81.9186 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1104	86.8337	83.5569	80.2802	77.0035	73.7267	73.7267	77.0035	80.2802	83.5569	86.8337	90.1104 (44)
Energy conte	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Energy content (annual)												Total = Sum(45)m = 1288.8982 (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	28.3966	24.8359	25.6284	22.3435	21.4391	18.5003	17.1432	19.6721	19.9071	23.1998	25.3244	27.5006 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	16.8939	15.0050	12.2029	9.2384	6.9058	5.8302	6.2997	8.1886	10.9907	13.9552	16.2878	17.3634 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	175.4116	177.2318	172.6449	162.8799	150.5534	138.9682	131.2286	129.4084	133.9953	143.7602	156.0868	167.6720 (68)
Pumps, fans	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681 (71)
Total internal gains	38.1675	36.9581	34.4468	31.0326	28.8160	25.6948	23.0420	26.4410	27.6487	31.1825	35.1727	36.9632 (72)
	283.6110	282.3330	272.4326	256.2889	239.4132	223.6312	213.7083	217.1760	225.7727	242.0359	260.6853	275.1366 (73)

6. Solar gains

[Jan]												Gains	
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		Specific data		Specific data		factor		
					W/m2		or Table 6b		or Table 6c		Table 6d		
North	3.0600				10.6334		0.6300		0.7000		0.7700		9.9441 (74)
West	5.2100				19.6403		0.6300		0.7000		0.7700		31.2721 (80)
Solar gains	41.2162	80.1785	133.0381	198.8014	249.9435	259.1353	245.3300	206.1528	155.9973	95.2105	51.2599	34.0065 (83)	
Total gains	324.8272	362.5115	405.4707	455.0903	489.3567	482.7665	459.0383	423.3288	381.7700	337.2464	311.9452	309.1431 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	56.7600	56.8874	57.0128	57.6096	57.7226	58.2547	58.2547	58.3544	58.0486	57.7226	57.4944	57.2577
util living area	4.7840	4.7925	4.8009	4.8406	4.8482	4.8836	4.8836	4.8903	4.8699	4.8482	4.8330	4.8172
MIT	0.9988	0.9977	0.9943	0.9806	0.9341	0.8143	0.6557	0.7193	0.9217	0.9893	0.9978	0.9991 (86)
MIT 2	19.5995	19.7276	19.9749	20.3243	20.6565	20.8898	20.9712	20.9552	20.7687	20.3451	19.9140	19.5783 (87)
util rest of house	19.9013	19.9034	19.9056	19.9157	19.9175	19.9263	19.9263	19.9280	19.9229	19.9175	19.9137	19.9097 (88)
MIT 2	0.9984	0.9969	0.9920	0.9721	0.9028	0.7277	0.5156	0.5832	0.8707	0.9832	0.9968	0.9988 (89)
Living area fraction	18.6252	18.7547	19.0027	19.3556	19.6719	19.8715	19.9185	19.9140	19.7819	19.3807	18.9493	18.6107 (90)
MIT	18.9973	19.1263	19.3740	19.7255	20.0479	20.2604	20.3206	20.3117	20.1587	19.7490	19.3177	18.9803 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9973	19.1263	19.3740	19.7255	20.0479	20.2604	20.3206	20.3117	20.1587	19.7490	19.3177	18.9803 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9979	0.9961	0.9906	0.9702	0.9073	0.7577	0.5701	0.6360	0.8842	0.9820	0.9961	0.9984 (94)
Ext temp.	324.1484	361.1089	401.6466	441.5433	444.0027	365.7820	261.6787	269.2286	337.5758	331.1726	310.7250	308.6375 (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	1096.5295	1059.9132	956.2393	795.7559	612.4325	411.4720	270.4589	283.8657	441.9933	671.2006	899.8909	1093.1339 (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	574.6516	468.9917	412.6170	255.0331	125.3118	0.0000	0.0000	0.0000	0.0000	252.9809	424.1994	583.6653 (98)
Space heating per m2												3097.4508 (98)
										(98) / (4) =		50.7945 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	683.3158	537.9295	551.5250	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8016	0.8781	0.8438	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	547.7672	472.3338	465.3732	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	639.8193	610.6526	570.2655	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	66.2775	102.9092	78.0399	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												247.2266 (104)
Intermittency factor (Table 10b)												fC = cooled area / (4) = 1.0000 (105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	16.5694	25.7273	19.5100	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												61.8067 (107)
Space cooling per m2												1.0136 (108)
Energy for space heating												50.7945 (99)
Energy for space cooling												1.0136 (108)
Total												51.8081 (109)
Target Fabric Energy Efficiency (TFEE)												59.6 (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	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (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							4.9300					
Infiltration rate							0.2465	(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) =	0.2095 (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)
	0.2305	0.2148	0.2148	0.2043	0.2043	0.1938	0.1938	0.1833	0.1833	0.1990	0.1938	0.2043 (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
Window (Uw = 1.40)			6.1500	1.3258	8.1534		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
150mm EPS B&B			60.9800	0.1800	10.9764	75.0000	4573.5000 (28a)
140mm Timber Frame	45.1600	8.2700	36.8900	0.1900	7.0091	9.0000	332.0100 (29a)
WTS	37.2100	2.1200	35.0900	0.1500	5.2635	18.0000	631.6200 (29a)
Total net area of external elements Aum(A, m ²)			143.3500	(26)...(30) + (32) =		35.5486	(31)
Fabric heat loss, W/K = Sum (A x U)							(33)
Party Ceilings			60.9800			30.0000	1829.4000 (32b)
Timber			122.1200			9.0000	1099.0800 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			8465.6100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.8260 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.8491 (36)
Total fabric heat loss				(33) + (36) =			50.3977 (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	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555 (38)
Heat transfer coeff	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532 (39)
Average = Sum(39)m / 12 =												75.7532 (39)
HLP	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423 (40)
HLP (average)												1.2423 (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												2.0092 (42)
Average daily hot water use (litres/day)												81.9186 (43)
Daily hot water use	Jan 90.1104	Feb 86.8337	Mar 83.5569	Apr 80.2802	May 77.0035	Jun 73.7267	Jul 73.7267	Aug 77.0035	Sep 80.2802	Oct 83.5569	Nov 86.8337	Dec 90.1104 (44)
Energy conte	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Energy content (annual)												Total = Sum(45)m = 1288.8982 (45)

Distribution loss	(46)m = 0.15 x (45)m											
	20.0447	17.5312	18.0906	15.7718	15.1335	13.0590	12.1011	13.8862	14.0520	16.3763	17.8760	19.4122 (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	14.5782	13.1455	14.5192	14.0115	14.4500	13.9509	14.3953	14.4308	13.9839	14.4906	14.0687	14.5668 (61)
Total heat required for water heating calculated for each month	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (64)
RHI water heating demand								Solar input (sum of months) = Sum(63)m =				
Heat gains from water heating, kWh/month	48.0769	42.1472	43.7307	38.4638	37.1583	32.4352	30.4230	34.3888	34.6447	39.9235	43.1424	46.6721 (65)
								Total per year (kWh/year) = Sum(64)m =				
								1459.4896 (64)				
								1459 (64)				

[illegible]

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	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (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					4.9300
Number of sides sheltered					0.2465 (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) =	0.2095 (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	0.2671	0.2619	0.2567	0.2305	0.2252	0.1990	0.1990	0.1938	0.2095	0.2252	0.2357	0.2462 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5171	0.5119	0.5067	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
Window (Uw = 1.40)			6.1500	1.3258	8.1534		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
150mm EPS B&B			60.9800	0.1800	10.9764	75.0000	4573.5000 (28a)
140mm Timber Frame	45.1600	8.2700	36.8900	0.1900	7.0091	9.0000	332.0100 (29a)
WTS	37.2100	2.1200	35.0900	0.1500	5.2635	18.0000	631.6200 (29a)
Total net area of external elements Aum(A, m ²)			143.3500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.5486		(33)
Party Ceilings			60.9800			30.0000	1829.4000 (32b)
Timber			122.1200			9.0000	1099.0800 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8465.6100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.8260 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.8491 (36)
Total fabric heat loss						(33) + (36) =	50.3977 (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	26.2249	25.9593	25.6936	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555 (38)
Heat transfer coeff	76.6226	76.3570	76.0913	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532 (39)
Average = Sum(39)m / 12 =												75.9041 (39)
HLP	1.2565	1.2522	1.2478	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423 (40)
HLP (average)												1.2447 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

												2.0092 (42)
Assumed occupancy												
Average daily hot water use (litres/day)												81.9186 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1104	86.8337	83.5569	80.2802	77.0035	73.7267	73.7267	77.0035	80.2802	83.5569	86.8337	90.1104 (44)
Energy conte	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Energy content (annual)										Total = Sum(45)m =		1288.8982 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	20.0447	17.5312	18.0906	15.7718	15.1335	13.0590	12.1011	13.8862	14.0520	16.3763	17.8760	19.4122 (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	14.5782	13.1455	14.5192	14.0115	14.4500	13.9509	14.3953	14.4308	13.9839	14.4906	14.0687	14.5668 (61)
Total heat required for water heating calculated for each month	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (64)
Heat gains from water heating, kWh/month	48.0769	42.1472	43.7307	38.4638	37.1583	32.4352	30.4230	34.3888	34.6447	39.9235	43.1424	46.6721 (65)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Total per year (kWh/year) = Sum(64)m =												1459.4896 (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	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.2347	37.5124	30.5072	23.0959	17.2644	14.5754	15.7492	20.4714	27.4767	34.8880	40.7194	43.4085	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.8083	264.5251	257.6790	243.1044	224.7066	207.4152	195.8635	193.1468	199.9929	214.5675	232.9653	250.2567	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	(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)	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	(71)
Water heating gains (Table 5)	64.6195	62.7191	58.7778	53.4220	49.9440	45.0489	40.8911	46.2215	48.1176	53.6606	59.9199	62.7313	(72)
Total internal gains	460.9110	457.0051	439.2124	411.8707	384.1635	359.2880	344.7523	352.0882	367.8357	395.3645	425.8532	448.6449	(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				3.0600	10.6334	0.7200	0.7000			0.7700			11.3647 (74)
West				3.0900	19.6403	0.7200	0.7000			0.7700			21.1968 (80)
West				2.1200	19.6403	0.7200	0.7000			0.7700			14.5428 (80)
Solar gains	47.1042	91.6326	152.0436	227.2016	285.6497	296.1546	280.3772	235.6032	178.2827	108.8120	58.5828	38.8646	(83)
Total gains	508.0152	548.6377	591.2560	639.0723	669.8132	655.4426	625.1295	587.6913	546.1184	504.1765	484.4359	487.5095	(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	30.6901	30.7969	30.9044	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	
alpha	3.0460	3.0531	3.0603	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	
util living area	0.9630	0.9510	0.9253	0.8700	0.7730	0.6317	0.4940	0.5379	0.7375	0.8908	0.9480	0.9669	(86)
MIT	19.1773	19.3663	19.7142	20.1651	20.5676	20.8362	20.9434	20.9251	20.7223	20.2158	19.6255	19.1450	(87)
Th 2	19.8750	19.8785	19.8819	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	(88)
util rest of house	0.9560	0.9418	0.9107	0.8433	0.7245	0.5504	0.3837	0.4273	0.6662	0.8627	0.9366	0.9607	(89)
MIT 2	17.4846	17.7582	18.2576	18.8918	19.4290	19.7518	19.8555	19.8423	19.6337	18.9759	18.1405	17.4452	(90)
Living area fraction	18.1311	18.3724	18.8139	19.3781	19.8639	20.1660	20.2710	20.2558	20.0495	19.4494	18.7077	18.0944	(91)
MIT	18.1311	18.3724	18.8139	19.3781	19.8639	20.1660	20.2710	20.2558	20.0495	19.4494	18.7077	18.0944	(92)
Temperature adjustment	17.9811	18.2224	18.6639	19.2281	19.7139	20.0160	20.1210	20.1058	19.8995	19.2994	18.5577	17.9444	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9401	0.9238	0.8906	0.8246	0.7160	0.5607	0.4082	0.4505	0.6672	0.8444	0.9186	0.9457	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1048.2822	1017.2572	925.5690	782.3879	607.0778	410.2762	266.7264	280.7293	439.3291	659.0093	867.9553	1041.1795	(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	424.6109	342.9966	296.8412	183.9148	94.8440	0.0000	0.0000	0.0000	0.0000	173.5567	304.5104	431.6103	(98)
Space heating												2252.8849	(98)
Space heating per m2												36.9447	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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													2489.3755 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	424.6109	342.9966	296.8412	183.9148	94.8440	0.0000	0.0000	0.0000	0.0000	173.5567	304.5104	431.6103	(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)	469.1833	379.0018	328.0013	203.2208	104.8000	0.0000	0.0000	0.0000	0.0000	191.7753	336.4756	476.9175	(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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814	(64)
Efficiency of water heater (217)m	89.6498	89.5973	89.4741	89.2143	88.7155	87.3000	87.3000	87.3000	87.3000	89.1405	89.5014	89.6777	(216)
Fuel for water heating, kWh/month	165.3204	145.1163	151.0196	133.5629	130.0108	115.7057	108.8997	122.5721	123.3267	138.7315	148.8716	160.5542	(219)
Water heating fuel used												1643.6915	(219)
Annual totals kWh/year													
Space heating fuel - main system												2489.3755	(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)												42.3609	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												117.3609	(231)
Electricity for lighting (calculated in Appendix L)												298.3509	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4548.7788	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2489.3755	3.4800	86.6303 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1643.6915	3.4800	57.2005 (247)
Mechanical ventilation fans	42.3609	13.1900	5.5874 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	298.3509	13.1900	39.3525 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			318.6631 (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] =	1.2629 (257)
SAP value	82.3830	
SAP rating (Section 12)	82	(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	2489.3755	0.2160	537.7051 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1643.6915	0.2160	355.0374 (264)
Space and water heating			892.7425 (265)
Pumps and fans	117.3609	0.5190	60.9103 (267)
Energy for lighting	298.3509	0.5190	154.8441 (268)
Energy saving/generation technologies			
PV Unit	-519.9000	0.5190	-269.8281 (269)
Total kg/year			838.6688 (272)
CO2 emissions per m2			13.7500 (273)
EI value			89.3960
EI rating			89
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	$3.48 / 0.8868 = 3.924$, stars = 4
Water heating environmental impact	$0.216 / 0.8868 = 0.2436$, 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	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (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									4.9300			
Infiltration rate									0.2465	(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) =		0.2095	(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)
	0.2305	0.2148	0.2148	0.2043	0.2043	0.1938	0.1938	0.1833	0.1833	0.1990	0.1938	0.2043 (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
Window (Uw = 1.40)			6.1500	1.3258	8.1534		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
150mm EPS B&B			60.9800	0.1800	10.9764	75.0000	4573.5000 (28a)
140mm Timber Frame	45.1600	8.2700	36.8900	0.1900	7.0091	9.0000	332.0100 (29a)
WTS	37.2100	2.1200	35.0900	0.1500	5.2635	18.0000	631.6200 (29a)
Total net area of external elements Aum(A, m ²)			143.3500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.5486		(33)
Party Ceilings			60.9800			30.0000	1829.4000 (32b)
Timber			122.1200			9.0000	1099.0800 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8465.6100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.8260 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.8491 (36)
Total fabric heat loss						(33) + (36) =	50.3977 (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	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555 (38)
Heat transfer coeff	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532	75.7532 (39)
Average = Sum(39)m / 12 =												75.7532 (39)
HLP	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423	1.2423 (40)
HLP (average)												1.2423 (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												2.0092 (42)
Average daily hot water use (litres/day)												81.9186 (43)
Daily hot water use	Jan 90.1104	Feb 86.8337	Mar 83.5569	Apr 80.2802	May 77.0035	Jun 73.7267	Jul 73.7267	Aug 77.0035	Sep 80.2802	Oct 83.5569	Nov 86.8337	Dec 90.1104 (44)
Energy conte	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Energy content (annual)										Total = Sum(45)m =		1288.8982 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	20.0447	17.5312	18.0906	15.7718	15.1335	13.0590	12.1011	13.8862	14.0520	16.3763	17.8760	19.4122 (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	14.5782	13.1455	14.5192	14.0115	14.4500	13.9509	14.3953	14.4308	13.9839	14.4906	14.0687	14.5668 (61)
Total heat required for water heating calculated for each month	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (64)
Heat gains from water heating, kWh/month	48.0769	42.1472	43.7307	38.4638	37.1583	32.4352	30.4230	34.3888	34.6447	39.9235	43.1424	46.6721 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1459.4896 (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	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.2347	37.5124	30.5072	23.0959	17.2644	14.5754	15.7492	20.4714	27.4767	34.8880	40.7194	43.4085	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.8083	264.5251	257.6790	243.1044	224.7066	207.4152	195.8635	193.1468	199.9929	214.5675	232.9653	250.2567	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	(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)	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	(71)
Water heating gains (Table 5)	64.6195	62.7191	58.7778	53.4220	49.9440	45.0489	40.8911	46.2215	48.1176	53.6606	59.9199	62.7313	(72)
Total internal gains	460.9110	457.0051	439.2124	411.8707	384.1635	359.2880	344.7523	352.0882	367.8357	395.3645	425.8532	448.6449	(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			3.0600		13.4839		0.7200		0.7000		0.7700		14.4112 (74)
West			3.0900		25.1925		0.7200		0.7000		0.7700		27.1891 (80)
West			2.1200		25.1925		0.7200		0.7000		0.7700		18.6540 (80)
Solar gains	60.2543	99.9958	167.4505	251.3746	298.1474	338.4663	309.3269	271.8415	205.7757	126.5843	74.7534		47.0192 (83)
Total gains	521.1652	557.0008	606.6629	663.2453	682.3109	697.7543	654.0792	623.9297	573.6114	521.9488	500.6065		495.6640 (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	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	31.0424	
alpha	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	3.0695	
util living area	0.9530	0.9405	0.9055	0.8326	0.7028	0.5094	0.3696	0.3858	0.6392	0.8442	0.9293	0.9578	(86)
MIT	19.4140	19.5646	19.9217	20.3493	20.7247	20.9285	20.9809	20.9785	20.8491	20.4417	19.8673	19.3808	(87)
Th 2	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	19.8863	(88)
util rest of house	0.9439	0.9289	0.8865	0.7980	0.6396	0.4134	0.2504	0.2621	0.5468	0.8026	0.9130	0.9494	(89)
MIT 2	17.8333	18.0482	18.5541	19.1416	19.6228	19.8404	19.8801	19.8793	19.7718	19.2811	18.4857	17.7867	(90)
Living area fraction									fLA = Living area / (4) =				0.3819 (91)
MIT	18.4371	18.6273	19.0764	19.6028	20.0437	20.2560	20.3006	20.2991	20.1832	19.7244	19.0134	18.3955	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.2871	18.4773	18.9264	19.4528	19.8937	20.1060	20.1506	20.1491	20.0332	19.5744	18.8634	18.2455	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9264	0.9099	0.8663	0.7824	0.6400	0.4333	0.2795	0.2923	0.5601	0.7887	0.8937	0.9327	(94)
Ext temp.	482.7967	506.8180	525.5484	518.9038	436.6850	302.3364	182.8365	182.3551	321.2699	411.6789	447.4036	462.2944	(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	976.2353	952.7737	858.0124	716.0824	514.6418	318.6167	185.6379	185.5283	358.5586	573.7840	792.6340	965.5127	(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	367.1183	299.6822	247.3532	141.9686	57.9999	0.0000	0.0000	0.0000	0.0000	120.6063	248.5659	374.3944	(98)
Space heating per m2												1857.6888	(98)
												(98) / (4) =	30.4639 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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													2052.6948 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	367.1183	299.6822	247.3532	141.9686	57.9999	0.0000	0.0000	0.0000	0.0000	120.6063	248.5659	374.3944	(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)	405.6556	331.1406	273.3185	156.8714	64.0883	0.0000	0.0000	0.0000	0.0000	133.2666	274.6584	413.6955	(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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814	(64)
Efficiency of water heater (217)m	89.5559	89.5073	89.3430	89.0112	88.3452	87.3000	87.3000	87.3000	87.3000	88.8512	89.3570	89.5879	(217)
Fuel for water heating, kWh/month	165.4937	145.2622	151.2411	133.8677	130.5557	115.7057	108.8997	122.5721	123.3267	139.1832	149.1123	160.7153	(219)
Water heating fuel used												1645.9354	(219)
Annual totals kWh/year													
Space heating fuel - main system												2052.6948	(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)													42.3609 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													117.3609 (231)
Electricity for lighting (calculated in Appendix L)													298.3509 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													4114.3419 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2052.6948	10.2300	209.9907 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1645.9354	10.2300	168.3792 (247)
Mechanical ventilation fans	42.3609	36.7200	15.5549 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	298.3509	36.7200	109.5544 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	36.7200	0.0000 (252)
Total energy cost			634.0192 (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	2052.6948	0.2160	443.3821 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1645.9354	0.2160	355.5220 (264)
Space and water heating			798.9041 (265)
Pumps and fans	117.3609	0.5190	60.9103 (267)
Energy for lighting	298.3509	0.5190	154.8441 (268)
Energy saving/generation technologies			
PV Unit	-519.9000	0.5190	-269.8281 (269)
Total kg/year			744.8304 (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	2052.6948	1.2200	2504.2877 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1645.9354	1.2200	2008.0411 (264)
Space and water heating			4512.3289 (265)
Pumps and fans	117.3609	3.0700	360.2978 (267)
Energy for lighting	298.3509	3.0700	915.9372 (268)
Energy saving/generation technologies			
PV Unit	-519.9000	3.0700	-1596.0930 (269)
Primary energy kWh/year			4192.4709 (272)
Primary energy kWh/m2/year			68.7516 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 82
Current environmental impact rating: B 89

(For testing purposes):		
A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	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 (none) Typical annual savings Energy efficiency Environmental impact

Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: B 82
Potential environmental impact rating: B 89

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	£153	£153	£0
Mains gas	£481	£481	£0
Space heating	£356	£356	£0
Water heating	£168	£168	£0
Lighting	£110	£110	£0
Total cost of fuels	£634	£634	£0
Total cost of uses	£634	£634	£0
Delivered energy	67 kWh/m²	67 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	69 kWh/m²	69 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

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	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	138.8 (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	152.13 (P1)
Transmission heat loss coefficient	50.40 (37)
Summer heat loss coefficient	202.53 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
West	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)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.0600	87.1704	0.7200	0.7000	0.9000	108.8946
West	3.0900	125.2818	0.7200	0.7000	0.9000	158.0382
West	2.1200	125.2818	0.7200	0.7000	0.9000	108.4275
total:						375.3602

	Jun	Jul	Aug	
Solar gains	406	375	323	(P3)
Internal gains	356	342	349	
Total summer gains	762	717	672	(P5)

Summer gain/loss ratio	3.76	3.54	3.32	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 138.8)	1.03	1.03	1.03	
Threshold temperature	20.19	21.87	21.65	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight