

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-217			Issued on Date	08/09/2023
Assessment Reference	As Built	Prop Type Ref	GF Flat Det		
Property	53, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	83 B	DER	14.87	TER	20.65
Environmental	90 B	% DER<TER	27.99		
CO ₂ Emissions (t/year)	0.71	DFEE	51.68	TFEE	56.55
General Requirements Compliance	Pass	% DFEE<TFEE	8.63		
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 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) 20.65 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.87 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.7 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	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.25 (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: 4.61 (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 East: 2.32 m², No overhang
Windows facing South: 1.43 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

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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	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) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.6100
Infiltration rate					0.2305 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2132 (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	0.2718	0.2665	0.2612	0.2345	0.2292	0.2026	0.2026	0.1972	0.2132	0.2292	0.2399	0.2505 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5005 (25)
Effective ac	0.5218	0.5165	0.5112	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5005 (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	
Window (Uw = 1.40)			6.8400	1.3258	9.0682			(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	60.3000	8.9600	51.3400	0.1900	9.7546	9.0000	462.0600	(29a)
WTS	22.0700	2.1200	19.9500	0.1500	2.9925	18.0000	359.1000	(29a)
Total net area of external elements Aum(A, m2)			143.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.9379			(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) =		8323.1400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							136.4897	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5572	(36)
Total fabric heat loss						(33) + (36) =	50.4951	(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	26.4633	26.1930	25.9227	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3821 (38)
Heat transfer coeff	76.9584	76.6881	76.4178	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8772 (39)
Average = Sum(39)m / 12 =												76.0622 (39)
HLP	1.2620	1.2576	1.2532	1.2439	1.2439	1.2439	1.2439	1.2439	1.2439	1.2439	1.2439	1.2443 (40)
HLP (average)												1.2473 (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	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)

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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	16.6032	14.7468	11.9929	9.0794	6.7870	5.7298	6.1913	8.0477	10.8016	13.7151	16.0075	17.0646 (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	312.7723	310.8357	299.5537	281.5193	263.4224	245.8850	234.4490	239.8155	249.0525	267.2739	288.1523	303.6059 (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
East				2.3200		19.6403	0.7200	0.7000		0.7700		15.9147 (76)
South				1.4300		46.7521	0.7200	0.7000		0.7700		23.3507 (78)
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	75.0050	139.2892	215.1236	297.7559	354.8093	359.6926	343.8235	301.3897	244.4288	161.1485	92.0854	62.6551 (83)
Total gains	387.7773	450.1249	514.6773	579.2752	618.2317	605.5776	578.2725	541.2052	493.4813	428.4224	380.2376	366.2610 (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	30.0420	30.1479	30.2545	30.4808	30.4808	30.4808	30.4808	30.4808	30.4808	30.4808	30.4808	30.4701
alpha	3.0028	3.0099	3.0170	3.0321	3.0321	3.0321	3.0321	3.0321	3.0321	3.0321	3.0321	3.0313
util living area	0.9807	0.9690	0.9445	0.8917	0.7992	0.6638	0.5254	0.5717	0.7736	0.9215	0.9705	0.9836 (86)
MIT	18.8931	19.1385	19.5483	20.0610	20.5055	20.8046	20.9300	20.9076	20.6687	20.0779	19.3964	18.8604 (87)
Th 2	19.8707	19.8742	19.8777	19.8851	19.8851	19.8851	19.8851	19.8851	19.8851	19.8851	19.8851	19.8847 (88)
util rest of house	0.9769	0.9628	0.9331	0.8684	0.7536	0.5829	0.4111	0.4583	0.7062	0.8997	0.9636	0.9804 (89)
MIT 2	17.0761	17.4331	18.0247	18.7534	19.3540	19.7210	19.8459	19.8292	19.5756	18.7924	17.8172	17.0368 (90)
Living area fraction									fLA = Living area / (4) =			0.3819 (91)
MIT	17.7701	18.0845	18.6066	19.2528	19.7938	20.1349	20.2600	20.2411	19.9931	19.2834	18.4203	17.7333 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6201	17.9345	18.4566	19.1028	19.6438	19.9849	20.1100	20.0911	19.8431	19.1334	18.2703	17.5833 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9657	0.9481	0.9141	0.8483	0.7422	0.5909	0.4357	0.4809	0.7033	0.8806	0.9494	0.9705 (94)
Ext temp.	374.4908	426.7549	470.4891	491.4212	458.8746	357.8163	251.9302	260.2715	347.0694	377.2829	361.0138	355.4427 (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	1025.0926	999.5893	913.7007	773.8901	602.5386	408.4473	266.2319	279.9696	435.6171	647.2602	847.2747	1015.4873 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	484.0477	384.9448	329.7494	203.3776	106.8860	0.0000	0.0000	0.0000	0.0000	200.8631	350.1079	491.0732 (98)
												2551.0497 (98)
												(98) / (4) = 41.8342 (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													2818.8394	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	484.0477	384.9448	329.7494	203.3776	106.8860	0.0000	0.0000	0.0000	0.0000	200.8631	350.1079	491.0732	(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)	534.8594	425.3533	364.3640	224.7266	118.1061	0.0000	0.0000	0.0000	0.0000	221.9482	386.8595	542.6223	(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	89.7290	89.6701	89.5459	89.2908	88.8104	87.3000	87.3000	87.3000	87.3000	89.2533	89.5947	89.7541	(216)	
Fuel for water heating, kWh/month	165.1744	144.9984	150.8984	133.4484	129.8719	115.7057	108.8997	122.5721	123.3267	138.5561	148.7166	160.4177	(219)	
Water heating fuel used												1642.5861	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2818.8394	(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)													293.2171	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
Total delivered energy for all uses													4872.0035	(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	2818.8394	0.2160	608.8693	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1642.5861	0.2160	354.7986	(264)
Space and water heating			963.6679	(265)
Pumps and fans	117.3609	0.5190	60.9103	(267)
Energy for lighting	293.2171	0.5190	152.1797	(268)
Energy saving/generation technologies				
PV Unit	-519.9000	0.5190	-269.8281	(269)
Total CO2, kg/year			906.9298	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.8700	(273)

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

DER			14.8700	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			34.6580	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			34.6580	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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 * 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					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3516 (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	0.4483	0.4395	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3516	0.3780	0.3956	0.4132 (22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5714	0.5558	0.5558	0.5529	0.5618	0.5714	0.5782	0.5854 (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)			8.9600	1.3258	11.8788		(27)
150mm EPS B&B			60.9800	0.1300	7.9274		(28a)
140mm Timber Frame	60.3000	8.9600	51.3400	0.1800	9.2412		(29a)
WTS	22.0700	2.1200	19.9500	0.1800	3.5910		(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) =	34.7584		(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)							9.5794 (36)
Total fabric heat loss						(33) + (36) =	44.3378 (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	30.4521	30.2542	30.0602	29.1491	28.9786	28.1850	28.1850	28.0380	28.4907	28.9786	29.3235	29.6840 (38)
Heat transfer coeff	74.7899	74.5920	74.3980	73.4869	73.3164	72.5228	72.5228	72.3758	72.8285	73.3164	73.6612	74.0218 (39)
Average = Sum(39)m / 12 =												73.4860 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2265	1.2232	1.2200	1.2051	1.2023	1.1893	1.1893	1.1869	1.1943	1.2023	1.2080	1.2139 (40)
HLP (average)												1.2051 (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	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)

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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	16.6032	14.7468	11.9929	9.0794	6.7870	5.7298	6.1913	8.0477	10.8016	13.7151	16.0075	17.0646	(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	323.3036	320.8140	308.9826	290.4008	271.7524	253.6654	242.2363	248.1520	257.9436	276.7124	298.1361	314.1410	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g or Table 6c	FF or Table 6c	Access factor Table 6d	Gains W
East	2.3200	19.6403	0.6300	0.7000	0.7700	13.9254	(76)
South	1.4300	46.7521	0.6300	0.7000	0.7700	20.4319	(78)
West	5.2100	19.6403	0.6300	0.7000	0.7700	31.2721	(80)

Solar gains	65.6294	121.8780	188.2332	260.5364	310.4581	314.7310	300.8456	263.7160	213.8752	141.0049	80.5747	54.8232	(83)
Total gains	388.9329	442.6921	497.2158	550.9372	582.2105	568.3964	543.0818	511.8680	471.8187	417.7174	378.7107	368.9643	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6216	56.7718	56.9198	57.6256	57.7596	58.3916	58.3916	58.5102	58.1465	57.7596	57.4891	57.2091	
alpha	4.7748	4.7848	4.7947	4.8417	4.8506	4.8928	4.8928	4.9007	4.8764	4.8506	4.8326	4.8139	
util living area	0.9974	0.9947	0.9867	0.9601	0.8874	0.7369	0.5688	0.6204	0.8549	0.9748	0.9948	0.9980	(86)
MIT	19.6921	19.8440	20.1056	20.4507	20.7480	20.9307	20.9844	20.9765	20.8485	20.4580	20.0137	19.6674	(87)
Th 2	19.8989	19.9015	19.9040	19.9159	19.9182	19.9286	19.9286	19.9305	19.9246	19.9182	19.9136	19.9089	(88)
util rest of house	0.9965	0.9928	0.9819	0.9446	0.8430	0.6432	0.4398	0.4908	0.7829	0.9621	0.9927	0.9973	(89)
MIT 2	18.1656	18.3889	18.7702	19.2702	19.6685	19.8818	19.9228	19.9208	19.8019	19.2897	18.6460	18.1366	(90)
Living area fraction	18.7486	18.9447	19.2802	19.7211	20.0808	20.2824	20.3283	20.3240	20.2016	19.7359	19.1684	18.7212	(91)
Temperature adjustment												0.0000	
adjusted MIT	18.7486	18.9447	19.2802	19.7211	20.0808	20.2824	20.3283	20.3240	20.2016	19.7359	19.1684	18.7212	(92)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9951	0.9906	0.9782	0.9411	0.8506	0.6764	0.4895	0.5406	0.8040	0.9593	0.9906	0.9962	(94)
Ext temp.	387.0350	438.5177	486.3657	518.5054	495.2413	384.4473	265.8351	276.7311	379.3600	400.7313	375.1679	367.5525	(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	1080.6116	1047.6195	950.8236	795.2075	614.4489	412.1044	270.3855	284.0045	444.3716	669.8100	888.9700	1074.8883	(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	(98)
Space heating per m2	516.0210	409.3164	345.5566	199.2255	88.6904	0.0000	0.0000	0.0000	0.0000	200.1946	369.9375	526.2578	(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													2842.8265 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	516.0210	409.3164	345.5566	199.2255	88.6904	0.0000	0.0000	0.0000	0.0000	200.1946	369.9375	526.2578	(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)	552.4850	438.2403	369.9750	213.3035	94.9576	0.0000	0.0000	0.0000	0.0000	214.3411	396.0787	563.4452	(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	87.5572	87.3561	86.8943	85.8560	83.9348	80.3000	80.3000	80.3000	80.3000	85.7495	87.0650	87.6450	(216)
Fuel for water heating, kWh/month	205.0664	179.5431	187.7959	168.5799	166.9509	153.6969	147.2533	164.1529	165.9658	176.9749	186.0628	200.0500	(219)
Water heating fuel used												2102.0929	(219)
Annual totals kWh/year													
Space heating fuel - main system												2842.8265	(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)												293.2171	(232)
Total delivered energy for all uses												5313.1365	(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	2842.8265	0.2160	614.0505 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2102.0929	0.2160	454.0521 (264)
Space and water heating			1068.1026 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	293.2171	0.5190	152.1797 (268)
Total CO2, kg/m2/year			1259.2073 (272)
Emissions per m2 for space and water heating			17.5156 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4956 (272b)
Emissions per m2 for pumps and fans			0.6383 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.5156 * 1.00) + 2.4956 + 0.6383, rounded to 2 d.p.			20.6500 (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) =				20.0000 / (5) = 0.1301 (8)
Pressure test					Yes
Measured/design AP50					4.6100
Infiltration rate					0.3606 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3336 (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	0.4253	0.4170	0.4087	0.3670	0.3586	0.3169	0.3169	0.3086	0.3336	0.3586	0.3753	0.3920 (22b)
Effective ac	0.5905	0.5869	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768 (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)			6.8400	1.3258	9.0682		(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	60.3000	8.9600	51.3400	0.1900	9.7546	9.0000	462.0600 (29a)
WTS	22.0700	2.1200	19.9500	0.1500	2.9925	18.0000	359.1000 (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) =		36.9379		(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) =	7713.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							126.4897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5572 (36)
Total fabric heat loss						(33) + (36) =	50.4951 (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	29.9427	29.7645	29.5899	28.7699	28.6164	27.9022	27.9022	27.7699	28.1773	28.6164	28.9268	29.2513 (38)
Heat transfer coeff	80.4378	80.2596	80.0851	79.2650	79.1115	78.3973	78.3973	78.2650	78.6724	79.1115	79.4219	79.7464 (39)
Average = Sum(39)m / 12 =												79.2642 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3191	1.3162	1.3133	1.2999	1.2973	1.2856	1.2856	1.2835	1.2901	1.2973	1.3024	1.3077 (40)
HLP (average)												1.2998 (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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1288.8982 (45)
Water 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 (46)

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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	16.6032	14.7468	11.9929	9.0794	6.7870	5.7298	6.1913	8.0477	10.8016	13.7151	16.0075	17.0646	(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	283.3203	282.0748	272.2226	256.1299	239.2944	223.5309	213.5999	217.0351	225.5836	241.7958	260.4050	274.8378	(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	
East	2.3200	19.6403	0.7200	0.7000	0.7700	15.9147	(76)
South	1.4300	46.7521	0.7200	0.7000	0.7700	23.3507	(78)
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	75.0050	139.2892	215.1236	297.7559	354.8093	359.6926	343.8235	301.3897	244.4288	161.1485	92.0854	62.6551	(83)
Total gains	358.3253	421.3639	487.3462	553.8858	594.1036	583.2236	557.4234	518.4248	470.0124	402.9443	352.4904	337.4929	(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	26.6367	26.6958	26.7540	27.0308	27.0832	27.3300	27.3300	27.3762	27.2344	27.0832	26.9774	26.8676	
alpha	2.7758	2.7797	2.7836	2.8021	2.8055	2.8220	2.8220	2.8251	2.8156	2.8055	2.7985	2.7912	
util living area	0.9812	0.9697	0.9462	0.8964	0.8102	0.6806	0.5464	0.5937	0.7885	0.9263	0.9717	0.9840	(86)
MIT	18.6143	18.8727	19.3131	19.8811	20.3843	20.7454	20.9019	20.8731	20.5823	19.9119	19.1596	18.5682	(87)
Th 2	19.8259	19.8282	19.8304	19.8409	19.8429	19.8521	19.8521	19.8538	19.8486	19.8429	19.8389	19.8348	(88)
util rest of house	0.9775	0.9638	0.9354	0.8743	0.7663	0.6004	0.4286	0.4782	0.7235	0.9059	0.9653	0.9809	(89)
MIT 2	17.6643	17.9214	18.3565	18.9146	19.3856	19.7025	19.8132	19.7994	19.5765	18.9565	18.2159	17.6247	(90)
Living area fraction									fLA = Living area / (4) =			0.3819	(91)
MIT	18.0271	18.2847	18.7219	19.2837	19.7670	20.1008	20.2290	20.2095	19.9606	19.3214	18.5764	17.9851	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0271	18.2847	18.7219	19.2837	19.7670	20.1008	20.2290	20.2095	19.9606	19.3214	18.5764	17.9851	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9699	0.9536	0.9224	0.8615	0.7630	0.6194	0.4698	0.5169	0.7308	0.8944	0.9558	0.9740	(94)
Ext temp.	347.5249	401.8027	449.5187	477.1581	453.3102	361.2225	261.8997	267.9658	343.4808	360.3785	336.9279	328.7332	(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	1104.1814	1074.2527	978.7906	823.0667	638.1941	431.2499	284.5046	298.1476	461.0689	689.9657	911.4746	1099.3086	(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	562.9524	451.8864	393.7783	249.0542	137.5537	0.0000	0.0000	0.0000	0.0000	245.2129	413.6736	573.3081	(98)
Space heating per m2												3027.4195	(98)
												49.6461	(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	736.9343	580.1397	594.8139	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7482	0.8145	0.7864	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	551.4047	472.4951	467.7573	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	757.1031	725.5039	681.2291	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	148.1028	188.2385	158.8230	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												495.1644 (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	37.0257	47.0596	39.7058	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												123.7911 (107)
Space cooling per m2												2.0300 (108)
Energy for space heating												49.6461 (99)
Energy for space cooling												2.0300 (108)
Total												51.6761 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.7 (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)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3516 (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	0.4483	0.4395	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3516	0.3780	0.3956	0.4132 (22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5714	0.5558	0.5558	0.5529	0.5618	0.5714	0.5782	0.5854 (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)			8.9600	1.3258	11.8788		(27)
150mm EPS B&B			60.9800	0.1300	7.9274		(28a)
140mm Timber Frame	60.3000	8.9600	51.3400	0.1800	9.2412		(29a)
WTS	22.0700	2.1200	19.9500	0.1800	3.5910		(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) =	34.7584		(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)							9.5794 (36)
Total fabric heat loss						(33) + (36) =	44.3378 (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	30.4521	30.2542	30.0602	29.1491	28.9786	28.1850	28.1850	28.0380	28.4907	28.9786	29.3235	29.6840 (38)
Heat transfer coeff	74.7899	74.5920	74.3980	73.4869	73.3164	72.5228	72.5228	72.3758	72.8285	73.3164	73.6612	74.0218 (39)
Average = Sum(39)m / 12 =												73.4860 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2265	1.2232	1.2200	1.2051	1.2023	1.1893	1.1893	1.1869	1.1943	1.2023	1.2080	1.2139 (40)
HLP (average)												1.2051 (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												
Water 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 (46)
Total storage loss												
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 (56)
	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												
	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												
	16.6032	14.7468	11.9929	9.0794	6.7870	5.7298	6.1913	8.0477	10.8016	13.7151	16.0075	17.0646 (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	283.3203	282.0748	272.2226	256.1299	239.2944	223.5309	213.5999	217.0351	225.5836	241.7958	260.4050	274.8378 (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
East		2.3200	19.6403	0.6300	0.7000	0.7700	13.9254 (76)
South		1.4300	46.7521	0.6300	0.7000	0.7700	20.4319 (78)
West		5.2100	19.6403	0.6300	0.7000	0.7700	31.2721 (80)

Solar gains	65.6294	121.8780	188.2332	260.5364	310.4581	314.7310	300.8456	263.7160	213.8752	141.0049	80.5747	54.8232 (83)
Total gains	348.9497	403.9528	460.4558	516.6663	549.7525	538.2620	514.4455	480.7511	439.4588	382.8008	340.9797	329.6611 (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	56.6216	56.7718	56.9198	57.6256	57.7596	58.3916	58.3916	58.5102	58.1465	57.7596	57.4891	57.2091
alpha	4.7748	4.7848	4.7947	4.8417	4.8506	4.8928	4.8928	4.9007	4.8764	4.8506	4.8326	4.8139
util living area	0.9984	0.9964	0.9903	0.9684	0.9048	0.7635	0.5961	0.6528	0.8803	0.9821	0.9967	0.9988 (86)
MIT	19.6320	19.7865	20.0529	20.4071	20.7187	20.9187	20.9810	20.9708	20.8233	20.4103	19.9575	19.6081 (87)
Th 2	19.8989	19.9015	19.9040	19.9159	19.9182	19.9286	19.9286	19.9305	19.9246	19.9182	19.9136	19.9089 (88)
util rest of house	0.9978	0.9951	0.9866	0.9556	0.8647	0.6713	0.4630	0.5200	0.8148	0.9726	0.9953	0.9983 (89)
MIT 2	18.6557	18.8117	19.0783	19.4344	19.7242	19.8902	19.9237	19.9220	19.8236	19.4439	18.9924	18.6397 (90)
Living area fraction									fLA = Living area / (4) =			0.3819 (91)
MIT	19.0286	19.1840	19.4506	19.8059	20.1040	20.2830	20.3275	20.3226	20.2054	19.8130	19.3610	19.0095 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0286	19.1840	19.4506	19.8059	20.1040	20.2830	20.3275	20.3226	20.2054	19.8130	19.3610	19.0095 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9972	0.9940	0.9846	0.9541	0.8727	0.7044	0.5145	0.5714	0.8347	0.9714	0.9944	0.9978 (94)
Useful gains	347.9631	401.5233	453.3838	492.9260	479.7567	379.1493	264.6942	274.6918	366.7990	371.8516	339.0568	328.9514 (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	1101.5484	1065.4734	963.4956	801.4418	616.1520	412.1475	270.3277	283.9002	444.6463	675.4637	903.1607	1096.2293 (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	560.6675	446.1745	379.5231	222.1314	101.4781	0.0000	0.0000	0.0000	0.0000	225.8874	406.1548	570.8548 (98)
Space heating												2912.8716 (98)
Space heating per m2										(98) / (4) =		47.7677 (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	681.7141	536.6686	550.0562	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8437	0.9101	0.8853	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	575.1496	488.4082	486.9802	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	704.5506	675.2699	637.1949	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	93.1687	139.0251	111.7598	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												343.9536 (104)
Cooled fraction												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

Intermittency factor (Table 10b)	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	23.2922	34.7563	27.9399	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											85.9884 (107)
Space cooling per m2											1.4101 (108)
Energy for space heating											47.7677 (99)
Energy for space cooling											1.4101 (108)
Total											49.1778 (109)
Target Fabric Energy Efficiency (TFEE)											56.6 (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	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					4.6100
Number of sides sheltered					0.2305 (18)
					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2132 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	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	0.2345	0.2185	0.2185	0.2079	0.2079	0.1972	0.1972	0.1866	0.1866	0.2026	0.1972	0.2079 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
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)			6.8400	1.3258	9.0682		8323.1400 (27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		136.4897 (27)
DTC			2.1200	0.6300	1.3356		13.5572 (26)
150mm EPS B&B			60.9800	0.1800	10.9764	75.0000	4573.5000 (28a)
140mm Timber Frame	60.3000	8.9600	51.3400	0.1900	9.7546	9.0000	462.0600 (29a)
WTS	22.0700	2.1200	19.9500	0.1500	2.9925	18.0000	359.1000 (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) =	36.9379		(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) =	8323.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							136.4897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5572 (36)
Total fabric heat loss						(33) + (36) =	50.4951 (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	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506 (39)
Average = Sum(39)m / 12 =												75.8506 (39)
HLP	1.2439	1.2439	1.2439	1.2439	1.2439	1.2439	1.2439	1.2439	1.2439	1.2439	1.2439	1.2439 (40)
HLP (average)												1.2439 (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	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 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	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							4.6100					
Infiltration rate							0.2305	(18)				
Number of sides sheltered							1	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.2132 (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												
	0.2718	0.2665	0.2612	0.2345	0.2292	0.2026	0.2026	0.1972	0.2132	0.2292	0.2399	0.2505 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5218	0.5165	0.5112	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5005 (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)			6.8400	1.3258	9.0682		(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	60.3000	8.9600	51.3400	0.1900	9.7546	9.0000	462.0600 (29a)
WTS	22.0700	2.1200	19.9500	0.1500	2.9925	18.0000	359.1000 (29a)
Total net area of external elements Aum(A, m ²)			143.3500	(26)...(30) + (32) =		36.9379	(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) =			8323.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							136.4897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5572 (36)
Total fabric heat loss				(33) + (36) =			50.4951 (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	26.4633	26.1930	25.9227	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3821 (38)
Heat transfer coeff	76.9584	76.6881	76.4178	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8772 (39)
Average = Sum(39)m / 12 =												76.0622 (39)
HLP	1.2620	1.2576	1.2532	1.2439	1.2439	1.2439	1.2439	1.2439	1.2439	1.2439	1.2439	1.2443 (40)
HLP (average)												1.2473 (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 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	41.5079	36.8670	29.9822	22.6985	16.9674	14.3246	15.4782	20.1192	27.0039	34.2877	40.0188	42.6616	(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	460.1842	456.3596	438.6875	411.4733	383.8664	359.0372	344.4813	351.7359	367.3629	394.7642	425.1525	447.8980	(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
East				2.3200		19.6403	0.7200	0.7000		0.7700		15.9147 (76)
South				1.4300		46.7521	0.7200	0.7000		0.7700		23.3507 (78)
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	75.0050	139.2892	215.1236	297.7559	354.8093	359.6926	343.8235	301.3897	244.4288	161.1485	92.0854	62.6551 (83)
Total gains	535.1892	595.6488	653.8111	709.2292	738.6757	718.7298	688.3048	653.1256	611.7917	555.9127	517.2379	510.5531 (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	30.0420	30.1479	30.2545	30.4808	30.4808	30.4808	30.4808	30.4808	30.4808	30.4808	30.4808	30.4701	
alpha	3.0028	3.0099	3.0170	3.0321	3.0321	3.0321	3.0321	3.0321	3.0321	3.0321	3.0321	3.0313	
util living area	0.9567	0.9390	0.9051	0.8391	0.7344	0.5915	0.4555	0.4938	0.6906	0.8648	0.9377	0.9616	(86)
MIT	19.1997	19.4256	19.7950	20.2449	20.6187	20.8588	20.9526	20.9382	20.7639	20.2791	19.6678	19.1661	(87)
Th 2	19.8707	19.8742	19.8777	19.8851	19.8851	19.8851	19.8851	19.8851	19.8851	19.8851	19.8851	19.8847	(88)
util rest of house	0.9488	0.9281	0.8878	0.8089	0.6833	0.5113	0.3512	0.3888	0.6169	0.8327	0.9246	0.9546	(89)
MIT 2	17.5159	17.8409	18.3672	18.9956	19.4872	19.7707	19.8596	19.8494	19.6748	19.0579	18.2005	17.4765	(90)
Living area fraction									fLA = Living area / (4) =			0.3819	(91)
MIT	18.1590	18.4461	18.9125	19.4727	19.9194	20.1863	20.2771	20.2653	20.0908	19.5243	18.7609	18.1218	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.0090	18.2961	18.7625	19.3227	19.7694	20.0363	20.1271	20.1153	19.9408	19.3743	18.6109	17.9718	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9313	0.9082	0.8665	0.7912	0.6775	0.5229	0.3748	0.4116	0.6210	0.8150	0.9052	0.9382	(94)
Useful gains	498.4002	540.9798	566.5356	561.1399	500.4403	375.8552	258.0032	268.8404	379.9217	453.0928	468.1968	479.0189	(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	1055.0228	1027.3247	937.0771	790.5716	612.0688	412.3464	267.5310	281.8051	443.0245	665.5370	873.1100	1044.9678	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	414.1272	326.8238	275.6828	165.1908	83.0516	0.0000	0.0000	0.0000	0.0000	158.0585	291.5375	421.0659	(98)
Space heating												2135.5381	(98)
Space heating per m2												35.0203	(99)
										(98) / (4) =			

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													2359.7106 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	414.1272	326.8238	275.6828	165.1908	83.0516	0.0000	0.0000	0.0000	0.0000	158.0585	291.5375	421.0659	(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)	457.5991	361.1313	304.6219	182.5313	91.7697	0.0000	0.0000	0.0000	0.0000	174.6502	322.1409	465.2662	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	148.2093	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	89.6341	89.5656	89.4219	89.1309	88.6116	87.3000	87.3000	87.3000	87.3000	89.0669	89.4713	89.6625	(216)
Fuel for water heating, kWh/month	165.3493	145.1675	151.1078	133.6879	130.1632	115.7057	108.8997	122.5721	123.3267	138.8461	148.9218	160.5815	(219)
Water heating fuel used												1644.3292	(219)
Annual totals kWh/year													
Space heating fuel - main system												2359.7106	(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)													293.2171 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													4414.6179 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2359.7106	3.4800	82.1179 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1644.3292	3.4800	57.2227 (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	293.2171	13.1900	38.6753 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			313.4958 (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] =	1.2424 (257)
SAP value		82.6687
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	2359.7106	0.2160	509.6975 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1644.3292	0.2160	355.1751 (264)
Space and water heating			864.8726 (265)
Pumps and fans	117.3609	0.5190	60.9103 (267)
Energy for lighting	293.2171	0.5190	152.1797 (268)
Energy saving/generation technologies			
PV Unit	-519.9000	0.5190	-269.8281 (269)
Total kg/year			808.1345 (272)
CO2 emissions per m2			13.2500 (273)
EI value			89.7820
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	$3.48 / 0.8865 = 3.926$, stars = 4
Water heating environmental impact	$0.216 / 0.8865 = 0.2437$, 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		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							4.6100					
Infiltration rate							0.2305		(18)			
Number of sides sheltered							1		(19)			
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250	(20)			
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.2132	(21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000
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
Adj infilt rate												
	0.2345	0.2185	0.2185	0.2079	0.2079	0.1972	0.1972	0.1866	0.1866	0.2026	0.1972	0.2079
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000
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

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)			6.8400	1.3258	9.0682		(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	60.3000	8.9600	51.3400	0.1900	9.7546	9.0000	462.0600 (29a)
WTS	22.0700	2.1200	19.9500	0.1500	2.9925	18.0000	359.1000 (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) =			36.9379	(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) =		8323.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							136.4897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5572 (36)
Total fabric heat loss					(33) + (36) =		50.4951 (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	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506	75.8506 (39)
Average = Sum(39)m / 12 =												75.8506 (39)
HLP	Jan 1.2439	Feb 1.2439	Mar 1.2439	Apr 1.2439	May 1.2439	Jun 1.2439	Jul 1.2439	Aug 1.2439	Sep 1.2439	Oct 1.2439	Nov 1.2439	Dec 1.2439 (40)
HLP (average)												1.2439 (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)

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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	41.5079	36.8670	29.9822	22.6985	16.9674	14.3246	15.4782	20.1192	27.0039	34.2877	40.0188	42.6616	(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	460.1842	456.3596	438.6875	411.4733	383.8664	359.0372	344.4813	351.7359	367.3629	394.7642	425.1525	447.8980	(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
East			2.3200		25.1925		0.7200		0.7000		0.7700		20.4138 (76)
South			1.4300		56.7559		0.7200		0.7000		0.7700		28.3472 (78)
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	94.6041	149.6247	232.9825	324.3215	365.4254	406.2155	374.5888	342.6453	277.4801	184.4280	115.7981	74.7871	(83)
Total gains	554.7883	605.9843	671.6700	735.7948	749.2919	765.2527	719.0701	694.3812	644.8430	579.1922	540.9506	522.6851	(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	30.4808	30.4808	30.4808	30.4808	30.4808	30.4808	30.4808	30.4808	30.4808	30.4808	30.4808	30.4808	
alpha	3.0321	3.0321	3.0321	3.0321	3.0321	3.0321	3.0321	3.0321	3.0321	3.0321	3.0321	3.0321	
util living area	0.9439	0.9260	0.8810	0.7971	0.6628	0.4718	0.3387	0.3499	0.5883	0.8100	0.9141	0.9506	(86)
MIT	19.4565	19.6329	20.0063	20.4200	20.7599	20.9396	20.9842	20.9827	20.8761	20.5003	19.9207	19.4115	(87)
Th 2	19.8851	19.8851	19.8851	19.8851	19.8851	19.8851	19.8851	19.8851	19.8851	19.8851	19.8851	19.8851	(88)
util rest of house	0.9334	0.9123	0.8588	0.7590	0.5986	0.3804	0.2284	0.2363	0.4977	0.7639	0.8953	0.9410	(89)
MIT 2	17.8943	18.1443	18.6684	19.2294	19.6584	19.8467	19.8800	19.8794	19.7930	19.3517	18.5592	17.8312	(90)
Living area fraction	18.4910	18.7128	19.1794	19.6841	20.0791	20.2641	20.3017	20.3008	20.2066	19.7904	19.0792	18.4348	(91)
MIT	18.4910	18.7128	19.1794	19.6841	20.0791	20.2641	20.3017	20.3008	20.2066	19.7904	19.0792	18.4348	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3410	18.5628	19.0294	19.5341	19.9291	20.1141	20.1517	20.1508	20.0566	19.6404	18.9292	18.2848	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	507.2619	540.3979	563.0773	548.4920	450.5654	306.0485	183.6694	183.3797	330.5630	435.6712	473.3267	482.3565	(94)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	981.5791	960.4823	866.9269	723.1686	517.9895	319.6405	185.9627	185.8961	360.7943	579.5277	798.6459	969.7337	(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	352.8920	282.2967	226.0641	125.7671	50.1635	0.0000	0.0000	0.0000	0.0000	107.0292	234.2298	362.6087	(98)
Space heating												1741.0510	(98)
Space heating per m2												28.5512	(99)
(98) / (4) =													

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													1923.8133 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	352.8920	282.2967	226.0641	125.7671	50.1635	0.0000	0.0000	0.0000	0.0000	107.0292	234.2298	362.6087	(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)	389.9359	311.9300	249.7946	138.9692	55.4292	0.0000	0.0000	0.0000	0.0000	118.2643	258.8175	400.6726	(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	89.5294	89.4659	89.2758	88.9144	88.2457	87.3000	87.3000	87.3000	87.3000	88.7560	89.3130	89.5669	(216)
Fuel for water heating, kWh/month	165.5427	145.3294	151.3551	134.0134	130.7029	115.7057	108.8997	122.5721	123.3267	139.3325	149.1857	160.7529	(219)
Water heating fuel used												1646.7188	(219)
Annual totals kWh/year													
Space heating fuel - main system												1923.8133	(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)													293.2171 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3981.1101 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1923.8133	10.2300	196.8061 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1646.7188	10.2300	168.4593 (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	293.2171	36.7200	107.6693 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	36.7200	0.0000 (252)
Total energy cost			619.0297 (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	1923.8133	0.2160	415.5437 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1646.7188	0.2160	355.6913 (264)
Space and water heating			771.2349 (265)
Pumps and fans	117.3609	0.5190	60.9103 (267)
Energy for lighting	293.2171	0.5190	152.1797 (268)
Energy saving/generation technologies			
PV Unit	-519.9000	0.5190	-269.8281 (269)
Total kg/year			714.4968 (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	1923.8133	1.2200	2347.0522 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1646.7188	1.2200	2008.9969 (264)
Space and water heating			4356.0492 (265)
Pumps and fans	117.3609	3.0700	360.2978 (267)
Energy for lighting	293.2171	3.0700	900.1766 (268)
Energy saving/generation technologies			
PV Unit	-519.9000	3.0700	-1596.0930 (269)
Primary energy kWh/year			4020.4306 (272)

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Primary energy kWh/m²/year

65.9303 (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	£151	£151	£0
Mains gas	£468	£468	£0
Space heating	£343	£343	£0
Water heating	£168	£168	£0
Lighting	£108	£108	£0
Total cost of fuels	£619	£619	£0
Total cost of uses	£619	£619	£0
Delivered energy	65 kWh/m ²	65 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m ²	12 kg/m ²	12 kg/m ²	0 kg/m ²
Primary energy	66 kWh/m ²	66 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	Detached 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	136.5 (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	50.50 (37)
Summer heat loss coefficient	202.63 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	2.3200	125.2818	0.7200	0.7000	0.9000	118.6565
South	1.4300	118.5567	0.7200	0.7000	0.9000	69.2114
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:						454.3335

Solar gains	Jun 487	Jul 454	Aug 407	(P3)
Internal gains	356	341	349	
Total summer gains	843	796	756	(P5)
Summer gain/loss ratio	4.16	3.93	3.73	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 136.5)	1.04	1.04	1.04	
Threshold temperature	20.61	22.27	22.07	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			