

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 84			Issued on Date	27/04/2023
Assessment Reference	84 Hamlewood	Prop Type Ref	21809		
Property	2 Hickory Way, HEDGE END, SO30 0AW				
SAP Rating	88 B	DER	12.89	TER	18.23
Environmental	91 B	% DER<TER	29.28		
CO ₂ Emissions (t/year)	0.63	DFEE	38.64	TFEE	45.93
General Requirements Compliance	Pass	% DFEE<TFEE	15.88		
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk			Assessor ID	Y128-0001
Client					

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

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DWELLING AS BUILT

Mid-Terrace House, total floor area 69 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) 18.23 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.89 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)45.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.33 (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: 4.10 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs 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: 0.1600 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading:
Average
Windows facing South East: 4.40 m², No overhang
Windows facing North West: 3.30 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Photovoltaic array 0.60 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour							
										heating	heating										
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans																0 * 10 =	0.0000 (7a)				
Number of passive vents																0 * 10 =	0.0000 (7b)				
Number of flueless gas fires																0 * 40 =	0.0000 (7c)				
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)					
Pressure test															Yes						
Measured/design AP50																4.1000					
Infiltration rate																0.2050 (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) =						0.1743 (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	0.2222	0.2178	0.2135	0.1917	0.1873	0.1655	0.1655	0.1612	0.1743	0.1873	0.1960	0.2047 (22b)									
Mechanical extract ventilation - decentralised																					
If mechanical ventilation:																					
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
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			7.7000	1.3258	10.2083		(27)
ground			34.6000	0.1100	3.8060	75.0000	2594.9999 (28a)
external	43.9400	11.9000	32.0400	0.2700	8.6508	150.0000	4805.9998 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5111		(33)
party			80.8000	0.0000	0.0000	45.0000	3636.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13513.7998 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							195.2861 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4709 (36)
Total fabric heat loss						(33) + (36) =	38.9820 (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	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305 (38)
Heat transfer coeff	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125 (39)
Average = Sum(39)m / 12 =												67.8125 (39)
HLP	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799 (40)
HLP (average)												0.9799 (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	2.2265 (42)
Average daily hot water use (litres/day)	87.0805 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1370.1151 (45)
	21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (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	14.0831	12.7005	14.0299	13.5417	13.9673	13.4869	13.9179	13.9499	13.5168	14.0040	13.5934	14.0728 (61)
Total heat required for water heating calculated for each month												
	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
Output from w/h												
	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (64)
								Total per year (kWh/year) = Sum (64)m =				1534.9792 (64)
Heat gains from water heating, kWh/month												
	50.7529	44.4847	46.1352	40.5493	39.1515	34.1433	31.9939	36.2081	36.4907	42.0892	45.5204	49.2600 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.6619	17.4635	14.2023	10.7521	8.0373	6.7854	7.3319	9.5303	12.7915	16.2417	18.9565	20.2084 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	195.4228	197.4506	192.3404	181.4615	167.7287	154.8219	146.1993	144.1714	149.2816	160.1606	173.8933	186.8002 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327 (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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Water heating gains (Table 5)	68.2163	66.1974	62.0097	56.3185	52.6229	47.4212	43.0025	48.6669	50.6815	56.5715	63.2228	66.2097 (72)
Total internal gains	342.6992	340.5098	327.9506	307.9303	287.7871	268.4267	255.9319	261.7667	272.1528	292.3720	315.4708	332.6165 (73)

6. Solar gains

[Jan]				Area	Solar flux		g		FF	Access		Gains
				m2	Table 6a		Specific data		Specific data	factor		W
					W/m2		or Table 6b		or Table 6c	Table 6d		
Southeast				4.4000	36.7938		0.4500		0.0000	0.7700		56.0959 (77)
Northwest				3.3000	11.2829		0.4500		0.0000	0.7700		12.9015 (81)

Solar gains	68.9974	121.8134	178.0530	239.6954	285.8933	291.4859	277.8358	242.1990	199.2156	137.6988	83.4233	58.5424 (83)
Total gains	411.6965	462.3232	506.0037	547.6257	573.6805	559.9127	533.7677	503.9657	471.3684	430.0708	398.8942	391.1589 (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	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561
alpha	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904
util living area	0.9945	0.9897	0.9780	0.9445	0.8609	0.7062	0.5423	0.5924	0.8212	0.9592	0.9897	0.9956 (86)
MIT	19.7672	19.9187	20.1673	20.4829	20.7668	20.9342	20.9848	20.9772	20.8622	20.5009	20.0660	19.7216 (87)
Th 2	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001 (88)
util rest of house	0.9930	0.9870	0.9721	0.9288	0.8213	0.6294	0.4391	0.4882	0.7587	0.9445	0.9866	0.9945 (89)
MIT 2	18.9703	19.1207	19.3663	19.6723	19.9322	20.0650	20.0950	20.0918	20.0161	19.6942	19.2680	18.9250 (90)
Living area fraction									fLA = Living area / (4) =			0.2153 (91)
MIT	19.1419	19.2925	19.5387	19.8469	20.1119	20.2522	20.2866	20.2824	20.1983	19.8679	19.4398	19.0965 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.9919	19.1425	19.3887	19.6969	19.9619	20.1022	20.1366	20.1324	20.0483	19.7179	19.2898	18.9465 (93)

8. Space heating requirement

Utilisation	0.9906	0.9833	0.9661	0.9202	0.8144	0.6296	0.4434	0.4921	0.7546	0.9365	0.9828	0.9925 (94)
Useful gains	407.8447	454.5971	488.8260	503.8994	467.1889	352.5236	236.6939	248.0204	355.7046	402.7579	392.0177	388.2285 (95)
Ext temp.	4.3000	4.9000	6.5000	8.0000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	996.2963	965.8206	874.0180	732.1616	560.2617	373.1157	239.8249	253.1036	403.3698	618.3099	826.6230	999.9983 (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	437.8080	343.5422	286.5828	164.3488	69.2462	0.0000	0.0000	0.0000	0.0000	160.3706	312.9158	455.1567 (98)
Space heating												2229.9712 (98)
Space heating per m2												(98) / (4) = 32.2250 (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												2464.0565 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	437.8080	343.5422	286.5828	164.3488	69.2462	0.0000	0.0000	0.0000	0.0000	160.3706	312.9158	455.1567 (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)	483.7657	379.6047	316.6661	181.6009	76.5152	0.0000	0.0000	0.0000	0.0000	177.2051	345.7634	502.9356 (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	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (64)
Efficiency of water heater (217)m	89.6363	89.5643	89.4129	89.0873	88.4369	87.3000	87.3000	87.3000	87.3000	89.0385	89.4847	87.3000 (216)
Fuel for water heating, kWh/month	174.1870	152.8954	159.0751	140.6631	137.0631	121.4582	114.1757	128.7033	129.5534	146.0703	156.7601	169.0954 (219)
Water heating fuel used												1729.7000 (219)
Annual totals kWh/year												
Space heating fuel - main system												2464.0565 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 6.1360, total flow = 29.0000, SFP = 0.2116)												
mechanical ventilation fans (SFP = 0.2116)												45.1040 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												120.1040 (231)
Electricity for lighting (calculated in Appendix L)												347.2353 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.60 * 1029 * 1.00) =										-494.0096		-494.0096 (233)
Total delivered energy for all uses												4167.0862 (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	2464.0565	0.2160	532.2362 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1729.7000	0.2160	373.6152 (264)
Space and water heating			905.8514 (265)
Pumps and fans	120.1040	0.5190	62.3340 (267)
Energy for lighting	347.2353	0.5190	180.2151 (268)
Energy saving/generation technologies			
PV Unit	-494.0096	0.5190	-256.3910 (269)
Total CO2, kg/year			892.0095 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.8900 (273)

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

DER			12.8900 ZC1
Total Floor Area		TFA	69.2000
Assumed number of occupants		N	2.2265
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.7346 ZC2
CO2 emissions from cooking, equation (L16)			2.4919 ZC3
Total CO2 emissions			32.1165 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			32.1165 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (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																2 * 10 =	20.0000 (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) =					20.0000	/ (5) =	0.1145 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3645 (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) =					0.3098 (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	0.3950	0.3872	0.3795	0.3408	0.3330	0.2943	0.2943	0.2866	0.3098	0.3330	0.3485	0.3640	(22b)				
Effective ac	0.5780	0.5750	0.5720	0.5581	0.5555	0.5433	0.5433	0.5411	0.5480	0.5555	0.5607	0.5663	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1000	1.0000	2.1000			(26)					
TER Semi-glazed door			2.1000	1.2000	2.5200			(26a)					
TER Opening Type (Uw = 1.40)			7.7000	1.3258	10.2083			(27)					
ground			34.6000	0.1300	4.4980			(28a)					
external	43.9400	11.9000	32.0400	0.1800	5.7672			(29a)					
cd	34.6000		34.6000	0.1300	4.4980			(30)					
Total net area of external elements Aum(A, m2)			113.1400					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.5915			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								8.6910 (36)					
Total fabric heat loss						(33) + (36) =		38.2825 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 33.3284	Feb 33.1537	Mar 32.9825	Apr 32.1784	May 32.0280	Jun 31.3276	Jul 31.3276	Aug 31.1979	Sep 31.5974	Oct 32.0280	Nov 32.3323	Dec 32.6505	(38)
Heat transfer coeff	71.6109	71.4363	71.2651	70.4609	70.3105	69.6101	69.6101	69.4804	69.8799	70.3105	70.6148	70.9330	(39)
Average = Sum(39)m / 12 =												70.4602	(39)
HLP	Jan 1.0348	Feb 1.0323	Mar 1.0298	Apr 1.0182	May 1.0160	Jun 1.0059	Jul 1.0059	Aug 1.0041	Sep 1.0098	Oct 1.0160	Nov 1.0204	Dec 1.0250	(40)
HLP (average)												1.0182	(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												2.2265 (42)
Average daily hot water use (litres/day)												87.0805 (43)
Daily hot water use	Jan 95.7885	Feb 92.3053	Mar 88.8221	Apr 85.3389	May 81.8557	Jun 78.3724	Jul 78.3724	Aug 81.8557	Sep 85.3389	Oct 88.8221	Nov 92.3053	Dec 95.7885 (44)
Energy conte	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Energy content (annual)										Total = Sum(45)m =		1370.1151 (45)
Distribution loss (46)m = 0.15 x (45)m	21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (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)

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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	0.0000 (57)
Combi loss	48.8128	42.4857	45.2628	42.0849	41.7127	38.6494	39.9377	41.7127	42.0849	45.2628	45.5204	48.8128	(61)
Total heat required for water heating calculated for each month	190.8644	166.7250	173.4666	153.8561	148.9598	131.1955	125.6953	140.1208	141.6683	161.3176	172.2033	186.3822	(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	190.8644	166.7250	173.4666	153.8561	148.9598	131.1955	125.6953	140.1208	141.6683	161.3176	172.2033	186.3822	(64)
Heat gains from water heating, kWh/month	59.4354	51.9310	53.9435	47.6851	46.0878	40.4339	38.4988	43.1489	43.6327	49.9039	53.5022	57.9450	(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	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.6619	17.4635	14.2023	10.7521	8.0373	6.7854	7.3319	9.5303	12.7915	16.2417	18.9565	20.2084	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	195.4228	197.4506	192.3404	181.4615	167.7287	154.8219	146.1993	144.1714	149.2816	160.1606	173.8933	186.8002	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	(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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	(71)
Water heating gains (Table 5)	79.8862	77.2783	72.5046	66.2294	61.9460	56.1582	51.7457	57.9958	60.6010	67.0752	74.3086	77.8831	(72)
Total internal gains	354.3691	351.5906	338.4456	317.8411	297.1102	277.1637	264.6751	271.0957	282.0723	302.8757	326.5566	344.2899	(73)

6. Solar gains

[Jan]												Gains	
			Area			Solar flux	g		FF		Access		W
			m2			Table 6a	or Table 6b		or Table 6c		factor		
						W/m2					Table 6d		
Southeast			4.4000			36.7938	0.6300		0.7000		0.7700		49.4766 (77)
Northwest			3.3000			11.2829	0.6300		0.7000		0.7700		11.3791 (81)
Solar gains	60.8557	107.4394	157.0428	211.4113	252.1579	257.0906	245.0512	213.6195	175.7082	121.4503	73.5794	51.6344	(83)
Total gains	415.2248	459.0300	495.4884	529.2524	549.2681	534.2543	509.7263	484.7152	457.7805	424.3260	400.1360	395.9242	(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	67.1064	67.2705	67.4321	68.2017	68.3476	69.0353	69.0353	69.1642	68.7688	68.3476	68.0530	67.7478	
alpha	5.4738	5.4847	5.4955	5.5468	5.5565	5.6024	5.6024	5.6109	5.5846	5.5565	5.5369	5.5165	
util living area	0.9980	0.9961	0.9908	0.9718	0.9109	0.7622	0.5866	0.6362	0.8692	0.9790	0.9959	0.9985	(86)
MIT	19.9166	20.0390	20.2474	20.5297	20.7863	20.9466	20.9898	20.9843	20.8827	20.5607	20.1896	19.8940	(87)
Th 2	20.0544	20.0565	20.0585	20.0682	20.0700	20.0784	20.0784	20.0800	20.0752	20.0700	20.0663	20.0625	(88)
util rest of house	0.9973	0.9948	0.9874	0.9608	0.8751	0.6792	0.4711	0.5205	0.8065	0.9687	0.9942	0.9980	(89)
MIT 2	18.6046	18.7847	19.0892	19.5011	19.8503	20.0406	20.0744	20.0730	19.9766	19.5508	19.0122	18.5775	(90)
Living area fraction	18.8871	19.0548	19.3386	19.7226	20.0518	20.2357	20.2715	20.2693	20.1717	19.7683	19.2657	18.8610	(92)
Temperature adjustment	18.8871	19.0548	19.3386	19.7226	20.0518	20.2357	20.2715	20.2693	20.1717	19.7683	19.2657	18.8610	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	413.6171	455.7148	487.5320	505.7450	480.2275	371.0627	252.8796	264.3632	372.6963	409.1472	397.0055	394.7311	(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	1044.5956	1011.1650	914.9402	762.5710	587.2225	392.3020	255.5719	268.8377	424.2884	644.6259	859.0798	1039.9489	(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	469.4480	373.2625	317.9917	184.9147	79.6043	0.0000	0.0000	0.0000	0.0000	175.1962	332.6935	480.0421	(98)
Space heating												2413.1530	(98)
Space heating per m2												34.8722	(99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2583.6755 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	469.4480	373.2625	317.9917	184.9147	79.6043	0.0000	0.0000	0.0000	0.0000	175.1962	332.6935	480.0421 (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)	502.6210	399.6387	340.4622	197.9815	85.2294	0.0000	0.0000	0.0000	0.0000	187.5762	356.2028	513.9637 (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	190.8644	166.7250	173.4666	153.8561	148.9598	131.1955	125.6953	140.1208	141.6683	161.3176	172.2033	186.3822 (64)
Efficiency of water heater (217)m	87.2287	87.0206	86.5573	85.5151	83.5511	80.3000	80.3000	80.3000	80.3000	85.2593	86.6815	80.3000 (216)
Fuel for water heating, kWh/month	218.8093	191.5926	200.4067	179.9169	178.2859	163.3817	156.5321	174.4966	176.4238	189.2083	198.6622	213.4276 (219)
Water heating fuel used												2241.1437 (219)
Annual totals kWh/year												
Space heating fuel - main system												2583.6755 (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)												347.2353 (232)
Total delivered energy for all uses												5247.0545 (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	2583.6755	0.2160	558.0739 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2241.1437	0.2160	484.0870 (264)
Space and water heating			1042.1609 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	347.2353	0.5190	180.2151 (268)
Total CO2, kg/m2/year			1261.3011 (272)
Emissions per m2 for space and water heating			15.0601 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6043 (272b)
Emissions per m2 for pumps and fans			0.5625 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0601 * 1.00) + 2.6043 + 0.5625, rounded to 2 d.p.			18.2300 (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	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (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) = 0.1145 (8)
Pressure test					Yes
Measured/design AP50					4.1000
Infiltration rate					0.3195 (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) =	0.2715 (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	0.3462	0.3394	0.3326	0.2987	0.2919	0.2580	0.2580	0.2512	0.2715	0.2919	0.3055	0.3191 (22b)
Effective ac	0.5599	0.5576	0.5553	0.5446	0.5426	0.5333	0.5333	0.5315	0.5369	0.5426	0.5467	0.5509 (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
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			7.7000	1.3258	10.2083		(27)
ground			34.6000	0.1100	3.8060	75.0000	2594.9999 (28a)
external	43.9400	11.9000	32.0400	0.2700	8.6508	150.0000	4805.9998 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5111		(33)
party			80.8000	0.0000	0.0000	45.0000	3636.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 13513.7998 (34)
195.2861 (35)
7.4709 (36)
(33) + (36) = 38.9820 (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	32.2863	32.1521	32.0205	31.4027	31.2871	30.7490	30.7490	30.6494	30.9563	31.2871	31.5210	31.7654 (38)
Heat transfer coeff	71.2683	71.1341	71.0026	70.3847	70.2691	69.7310	69.7310	69.6314	69.9383	70.2691	70.5030	70.7475 (39)
Average = Sum(39)m / 12 =												70.3842 (39)
HLP	1.0299	1.0279	1.0260	1.0171	1.0155	1.0077	1.0077	1.0062	1.0107	1.0155	1.0188	1.0224 (40)
HLP (average)												1.0171 (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												2.2265 (42)
Average daily hot water use (litres/day)												87.0805 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy conte	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Energy content (annual)										Total = Sum(45)m =		1370.1151 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.1860	26.4008	27.2433	23.7514	22.7900	19.6660	18.2235	20.9117	21.1615	24.6616	26.9201	29.2335 (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	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.6619	17.4635	14.2023	10.7521	8.0373	6.7854	7.3319	9.5303	12.7915	16.2417	18.9565	20.2084	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	195.4228	197.4506	192.3404	181.4615	167.7287	154.8219	146.1993	144.1714	149.2816	160.1606	173.8933	186.8002	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	(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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	(71)
Water heating gains (Table 5)	40.5725	39.2870	36.6173	32.9880	30.6317	27.3140	24.4939	28.1071	29.3909	33.1474	37.3890	39.2923	(72)
Total internal gains	312.0554	310.5993	299.5583	281.5997	262.7959	245.3194	234.4233	238.2070	247.8622	265.9479	286.6371	302.6991	(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	
Southeast	4.4000				36.7938		0.4500		0.0000		0.7700		56.0959 (77)	
Northwest	3.3000				11.2829		0.4500		0.0000		0.7700		12.9015 (81)	
Solar gains	68.9974	121.8134	178.0530	239.6954	285.8933	291.4859	277.8358	242.1990	199.2156	137.6988	83.4233	58.5424 (83)		
Total gains	381.0528	432.4127	477.6113	521.2951	548.6892	536.8054	512.2591	480.4060	447.0779	403.6467	370.0604	361.2415 (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	52.6719	52.7712	52.8690	53.3331	53.4208	53.8330	53.8330	53.9101	53.6735	53.4208	53.2436	53.0596	
alpha	4.5115	4.5181	4.5246	4.5555	4.5614	4.5889	4.5889	4.5940	4.5782	4.5614	4.5496	4.5373	
util living area	0.9960	0.9923	0.9832	0.9556	0.8838	0.7380	0.5747	0.6282	0.8506	0.9690	0.9926	0.9969	(86)
MIT	19.6335	19.7922	20.0552	20.4024	20.7149	20.9151	20.9790	20.9687	20.8268	20.4256	19.9646	19.6011	(87)
Th 2	20.0585	20.0601	20.0617	20.0691	20.0705	20.0769	20.0769	20.0781	20.0745	20.0705	20.0677	20.0647	(88)
util rest of house	0.9949	0.9903	0.9784	0.9423	0.8475	0.6609	0.4651	0.5189	0.7919	0.9571	0.9902	0.9960	(89)
MIT 2	18.8044	18.9636	19.2255	19.5705	19.8621	20.0309	20.0698	20.0665	19.9664	19.5984	19.1419	18.7771	(90)
Living area fraction									fLA = Living area / (4) =			0.2153	(91)
MIT	18.9829	19.1420	19.4042	19.7496	20.0458	20.2213	20.2656	20.2608	20.1517	19.7765	19.3190	18.9545	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9829	19.1420	19.4042	19.7496	20.0458	20.2213	20.2656	20.2608	20.1517	19.7765	19.3190	18.9545	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9933	0.9876	0.9742	0.9367	0.8464	0.6740	0.4885	0.5418	0.7975	0.9523	0.9877	0.9947	(94)
Ext temp.	378.5017	427.0720	465.2787	488.2764	464.3894	361.7873	250.2234	260.2751	356.5645	384.4039	365.5008	359.3202	(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	1046.4277	1013.0939	916.2295	763.6467	586.4490	391.9806	255.6058	268.8311	423.2453	644.8240	861.4790	1043.8433	(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	496.9369	393.8067	335.5074	198.2666	90.8123	0.0000	0.0000	0.0000	0.0000	193.7525	357.1043	509.2852	(98)
Space heating per m2												2575.4720	(98)
										(98) / (4) =		37.2178	(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	655.4718	516.0097	529.1986	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8528	0.9139	0.8921	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	559.0155	471.5660	472.0976	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	711.1695	680.8914	645.3205	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	109.5509	155.7381	128.8778	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												394.1668 (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	27.3877	38.9345	32.2195	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												98.5417 (107)
Space cooling per m2												1.4240 (108)
Energy for space heating												37.2178 (99)
Energy for space cooling												1.4240 (108)
Total												38.6418 (109)
Dwelling Fabric Energy Efficiency (DFEE)												38.6 (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	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (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) = 0.1145 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3645 (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) =	0.3098 (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	0.3950	0.3872	0.3795	0.3408	0.3330	0.2943	0.2943	0.2866	0.3098	0.3330	0.3485	0.3640 (22b)
Effective ac	0.5780	0.5750	0.5720	0.5581	0.5555	0.5433	0.5433	0.5411	0.5480	0.5555	0.5607	0.5663 (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			2.1000	1.0000	2.1000		(26)
TER Semi-glazed door			2.1000	1.2000	2.5200		(26a)
TER Opening Type (Uw = 1.40)			7.7000	1.3258	10.2083		(27)
ground			34.6000	0.1300	4.4980		(28a)
external	43.9400	11.9000	32.0400	0.1800	5.7672		(29a)
cd	34.6000		34.6000	0.1300	4.4980		(30)
Total net area of external elements Aum(A, m ²)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.5915		(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)							8.6910 (36)
Total fabric heat loss						(33) + (36) =	38.2825 (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	33.3284	33.1537	32.9825	32.1784	32.0280	31.3276	31.3276	31.1979	31.5974	32.0280	32.3323	32.6505 (38)
Heat transfer coeff	71.6109	71.4363	71.2651	70.4609	70.3105	69.6101	69.6101	69.4804	69.8799	70.3105	70.6148	70.9330 (39)
Average = Sum(39)m / 12 =												70.4602 (39)
HLP	1.0348	1.0323	1.0298	1.0182	1.0160	1.0059	1.0059	1.0041	1.0098	1.0160	1.0204	1.0250 (40)
HLP (average)												1.0182 (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												2.2265 (42)
Average daily hot water use (litres/day)												87.0805 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1370.1151 (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)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	30.1860	26.4008	27.2433	23.7514	22.7900	19.6660	18.2235	20.9117	21.1615	24.6616	26.9201	29.2335 (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	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	19.6619	17.4635	14.2023	10.7521	8.0373	6.7854	7.3319	9.5303	12.7915	16.2417	18.9565	20.2084 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	195.4228	197.4506	192.3404	181.4615	167.7287	154.8219	146.1993	144.1714	149.2816	160.1606	173.8933	186.8002 (68)
Pumps, fans	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327 (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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Total internal gains	40.5725	39.2870	36.6173	32.9880	30.6317	27.3140	24.4939	28.1071	29.3909	33.1474	37.3890	39.2923 (72)
	312.0554	310.5993	299.5583	281.5997	262.7959	245.3194	234.4233	238.2070	247.8622	265.9479	286.6371	302.6991 (73)

6. Solar gains												

[Jan]				Area	Solar flux		g	FF		Access		Gains
				m2	Table 6a		Specific data	Specific data		factor		W
					W/m2		or Table 6b	or Table 6c		Table 6d		
Southeast				4.4000	36.7938		0.6300	0.7000		0.7700		49.4766 (77)
Northwest				3.3000	11.2829		0.6300	0.7000		0.7700		11.3791 (81)

Solar gains	60.8557	107.4394	157.0428	211.4113	252.1579	257.0906	245.0512	213.6195	175.7082	121.4503	73.5794	51.6344 (83)
Total gains	372.9111	418.0387	456.6011	493.0111	514.9538	502.4100	479.4745	451.8265	423.5704	387.3982	360.2165	354.3335 (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	67.1064	67.2705	67.4321	68.2017	68.3476	69.0353	69.0353	69.1642	68.7688	68.3476	68.0530	67.7478
util living area	5.4738	5.4847	5.4955	5.5468	5.5565	5.6024	5.6024	5.6109	5.5846	5.5565	5.5369	5.5165
	0.9988	0.9975	0.9937	0.9792	0.9288	0.7932	0.6190	0.6744	0.8973	0.9860	0.9975	0.9991 (86)
MIT	19.8585	19.9832	20.1958	20.4858	20.7557	20.9345	20.9868	20.9792	20.8578	20.5142	20.1351	19.8367 (87)
Th 2	20.0544	20.0565	20.0585	20.0682	20.0700	20.0784	20.0784	20.0800	20.0752	20.0700	20.0663	20.0625 (88)
util rest of house												
	0.9984	0.9967	0.9914	0.9707	0.8980	0.7125	0.4995	0.5556	0.8420	0.9788	0.9965	0.9988 (89)
MIT 2	19.0066	19.1327	19.3459	19.6394	19.8946	20.0458	20.0747	20.0735	19.9903	19.6712	19.2926	18.9914 (90)
Living area fraction												
MIT	19.1900	19.3158	19.5289	19.8216	20.0800	20.2371	20.2711	20.2685	20.1771	19.8527	19.4740	19.1734 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1900	19.3158	19.5289	19.8216	20.0800	20.2371	20.2711	20.2685	20.1771	19.8527	19.4740	19.1734 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9979	0.9958	0.9896	0.9679	0.8983	0.7278	0.5255	0.5814	0.8492	0.9765	0.9956	0.9984 (94)
Ext temp.	372.1390	416.2653	451.8588	477.1643	462.6074	365.6510	251.9769	262.6805	359.7068	378.3009	358.6452	353.7796 (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)
	1066.2891	1029.8143	928.5053	769.5489	589.2012	392.4024	255.5462	268.7840	424.6682	650.5618	873.7894	1062.1100 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	516.4477	412.3050	354.6250	210.5169	94.1858	0.0000	0.0000	0.0000	0.0000	202.5621	370.9039	526.9978 (98)
Space heating												2688.5441 (98)
Space heating per m2										(98) / (4) =		38.8518 (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	654.3351	515.1149	528.0512	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8590	0.9251	0.9037	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	562.0609	476.5464	477.2163	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	670.9672	642.5717	611.9159	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	78.4125	123.5229	100.2165	0.0000	0.0000	0.0000	0.0000 (104)
												302.1519 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	19.6031	30.8807	25.0541	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												75.5380 (107)
Space cooling per m2												1.0916 (108)
Energy for space heating												38.8518 (99)
Energy for space cooling												1.0916 (108)
Total												39.9434 (109)
Target Fabric Energy Efficiency (TFEE)												45.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.7300 (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					4.1000
Infiltration rate					0.2050 (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) =		0.1743 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.2047	0.1917	0.1917	0.1743	0.1786	0.1699	0.1699	0.1655	0.1655	0.1786	0.1743	0.1786 (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
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			7.7000	1.3258	10.2083		(27)
ground			34.6000	0.1100	3.8060	75.0000	2594.9999 (28a)
external	43.9400	11.9000	32.0400	0.2700	8.6508	150.0000	4805.9998 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5111		(33)
party			80.8000	0.0000	0.0000	45.0000	3636.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13513.7998 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							195.2861 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4709 (36)
Total fabric heat loss						(33) + (36) =	38.9820 (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	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305 (38)
Heat transfer coeff	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125 (39)
Average = Sum(39)m / 12 =												67.8125 (39)
HLP	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799 (40)
HLP (average)												0.9799 (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												2.2265 (42)
Average daily hot water use (litres/day)												87.0805 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1370.1151 (45)
	21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (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	14.0831	12.7005	14.0299	13.5417	13.9673	13.4869	13.9179	13.9499	13.5168	14.0040	13.5934	14.0728 (61)
Total heat required for water heating calculated for each month	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
Output from w/h	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (64)
								Total per year (kWh/year) = Sum (64)m =				1534.9792 (64)
RHI water heating demand												1535 (64)
Heat gains from water heating, kWh/month	50.7529	44.4847	46.1352	40.5493	39.1515	34.1433	31.9939	36.2081	36.4907	42.0892	45.5204	49.2600 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.1548	43.6588	35.5057	26.8801	20.0932	16.9635	18.3297	23.8256	31.9787	40.6043	47.3912	50.5209 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6757	294.7024	287.0753	270.8380	250.3414	231.0774	218.2079	215.1812	222.8084	239.0456	259.5423	278.8062 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858 (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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Water heating gains (Table 5)	68.2163	66.1974	62.0097	56.3185	52.6229	47.4212	43.0025	48.6669	50.6815	56.5715	63.2228	66.2097 (72)
Total internal gains	507.1636	502.6754	482.7075	452.1534	421.1743	393.5789	377.6569	385.7905	403.5853	434.3382	468.2731	493.6536 (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	
Southeast				4.4000	45.0642		0.4500		0.0000	0.7700	68.7048 (77)	
Northwest				3.3000	14.6130		0.4500		0.0000	0.7700	16.7093 (81)	

Solar gains	85.4141	128.7294	192.6372	262.0150	295.1900	333.3965	305.1898	276.8608	226.2256	157.3222	103.0133	68.5587 (83)
Total gains	592.5777	631.4048	675.3446	714.1684	716.3643	726.9754	682.8466	662.6513	629.8109	591.6605	571.2864	562.2124 (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	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561
alpha	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904
util living area	0.9684	0.9566	0.9217	0.8381	0.6881	0.4680	0.3265	0.3263	0.5793	0.8324	0.9412	0.9733 (86)
MIT	20.1979	20.2955	20.5120	20.7603	20.9271	20.9904	20.9986	20.9987	20.9746	20.8106	20.4831	20.1640 (87)
Th 2	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001 (88)
util rest of house	0.9609	0.9465	0.9035	0.8023	0.6267	0.3888	0.2381	0.2352	0.4956	0.7867	0.9251	0.9667 (89)
MIT 2	19.3944	19.4887	19.6952	19.9208	20.0562	20.0964	20.0998	20.0998	20.0888	19.9687	19.6716	19.3618 (90)
Living area fraction	19.5674	19.6625	19.8711	20.1015	20.2438	20.2889	20.2934	20.2934	fLA = Living area / (4) =	20.2796	20.1500	19.8463 (91)
MIT	19.5674	19.6625	19.8711	20.1015	20.2438	20.2889	20.2934	20.2934	20.2796	20.1500	19.8463	19.5346 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.4174	19.5125	19.7211	19.9515	20.0938	20.1389	20.1434	20.1434	20.1296	20.0000	19.6963	19.3846 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9537	0.9384	0.8945	0.7957	0.6263	0.3923	0.2424	0.2396	0.4985	0.7810	0.9164	0.9601 (94)
Ext temp.	565.1615	592.5054	604.1266	568.2493	448.6521	285.2002	165.5260	158.7613	313.9350	462.0910	523.5410	539.7951 (95)
Heat loss rate W	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Month fracti	936.9923	916.3134	821.9592	668.0565	474.2637	287.4504	165.6897	158.9104	320.7235	535.7200	752.4672	927.9834 (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	276.6421	217.5990	162.0675	71.8612	19.0550	0.0000	0.0000	0.0000	0.0000	54.7799	164.8268	288.8121 (98)
RHI space heating demand												1255.6437 (98)
												1256 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour							
										heating	heating										
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans																0 * 10 =	0.0000 (7a)				
Number of passive vents																0 * 10 =	0.0000 (7b)				
Number of flueless gas fires																0 * 40 =	0.0000 (7c)				
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)					
Pressure test															Yes						
Measured/design AP50															4.1000						
Infiltration rate															0.2050 (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) =					0.1743 (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	0.2222	0.2178	0.2135	0.1917	0.1873	0.1655	0.1655	0.1612	0.1743	0.1873	0.1960	0.2047 (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
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			7.7000	1.3258	10.2083		(27)
ground			34.6000	0.1100	3.8060	75.0000	2594.9999 (28a)
external	43.9400	11.9000	32.0400	0.2700	8.6508	150.0000	4805.9998 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5111		(33)
party			80.8000	0.0000	0.0000	45.0000	3636.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13513.7998 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							195.2861 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4709 (36)
Total fabric heat loss						(33) + (36) =	38.9820 (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	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305 (38)
Heat transfer coeff	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125 (39)
Average = Sum(39)m / 12 =												67.8125 (39)
HLP	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799 (40)
HLP (average)												0.9799 (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	2.2265 (42)
Average daily hot water use (litres/day)	87.0805 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1370.1151 (45)
Water storage loss:	21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (46)
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	14.0831	12.7005	14.0299	13.5417	13.9673	13.4869	13.9179	13.9499	13.5168	14.0040	13.5934	14.0728 (61)
Total heat required for water heating calculated for each month	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (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	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (64)
Heat gains from water heating, kWh/month	50.7529	44.4847	46.1352	40.5493	39.1515	34.1433	31.9939	36.2081	36.4907	42.0892	45.5204	49.2600 (65)
										Total per year (kWh/year) = Sum (64)m =		1534.9792 (64)

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	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	49.1548	43.6588	35.5057	26.8801	20.0932	16.9635	18.3297	23.8256	31.9787	40.6043	47.3912	50.5209 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	291.6757	294.7024	287.0753	270.8380	250.3414	231.0774	218.2079	215.1812	222.8084	239.0456	259.5423	278.8062 (68)
Pumps, fans	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Total internal gains	68.2163	66.1974	62.0097	56.3185	52.6229	47.4212	43.0025	48.6669	50.6815	56.5715	63.2228	66.2097 (72)
	507.1636	502.6754	482.7075	452.1534	421.1743	393.5789	377.6569	385.7905	403.5853	434.3382	468.2731	493.6536 (73)

6. Solar gains

[Jan]												Gains
				Area	Solar flux		g		FF		Access	
				m2	Table 6a		or Table 6b		or Table 6c		factor	W
					W/m2						Table 6d	
Southeast				4.4000	36.7938		0.4500		0.0000		0.7700	56.0959 (77)
Northwest				3.3000	11.2829		0.4500		0.0000		0.7700	12.9015 (81)
Solar gains	68.9974	121.8134	178.0530	239.6954	285.8933	291.4859	277.8358	242.1990	199.2156	137.6988	83.4233	58.5424 (83)
Total gains	576.1609	624.4888	660.7605	691.8488	707.0676	685.0649	655.4926	627.9895	602.8009	572.0370	551.6964	552.1960 (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	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561
util living area	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904
MIT	0.9789	0.9675	0.9433	0.8866	0.7741	0.6040	0.4489	0.4872	0.7069	0.8984	0.9647	0.9825 (86)
Th 2	20.0308	20.1687	20.3862	20.6468	20.8579	20.9656	20.9930	20.9898	20.9287	20.6738	20.3003	19.9826 (87)
util rest of house	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001 (88)
MIT 2	0.9741	0.9601	0.9302	0.8604	0.7253	0.5296	0.3601	0.3963	0.6361	0.8694	0.9554	0.9784 (89)
Living area fraction	19.2302	19.3650	19.5756	19.8201	20.0033	20.0828	20.0979	20.0966	20.0601	19.8497	19.4957	19.1829 (90)
MIT	19.4025	19.5380	19.7501	19.9981	20.1873	20.2729	20.2906	20.2889	20.2472	20.0271	19.6689	19.3551 (91)
Temperature adjustment												-0.1500
adjusted MIT	19.2525	19.3880	19.6001	19.8481	20.0373	20.1229	20.1406	20.1389	20.0972	19.8771	19.5189	19.2051 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9683	0.9529	0.9215	0.8520	0.7216	0.5316	0.3642	0.4003	0.6359	0.8610	0.9479	0.9732 (94)
Ext temp.	557.8728	595.0923	608.8970	589.4727	510.2423	364.1929	238.7239	251.3841	383.3027	492.5480	522.9356	537.3763 (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	1013.9694	982.4678	888.3518	742.4156	565.3735	374.5201	240.0975	253.5440	406.6821	629.1034	842.1591	1017.5303 (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	339.3359	260.3164	207.9143	110.1189	41.0176	0.0000	0.0000	0.0000	0.0000	101.5972	229.8410	357.2345 (98)
Space heating per m2												1647.3758 (98)
										(98) / (4) =		23.8060 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1820.3048	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	339.3359	260.3164	207.9143	110.1189	41.0176	0.0000	0.0000	0.0000	0.0000	101.5972	229.8410	357.2345	(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)	374.9568	287.6424	229.7396	121.6783	45.3233	0.0000	0.0000	0.0000	0.0000	112.2621	253.9679	394.7343	(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	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422	(64)
Efficiency of water heater	89.4666	89.3708	89.1723	88.7681	88.0875	87.3000	87.3000	87.3000	87.3000	88.6751	89.2600	87.3000	(216)
(217)m	89.4666	89.3708	89.1723	88.7681	88.0875	87.3000	87.3000	87.3000	87.3000	88.6751	89.2600	89.5221	(217)
Fuel for water heating, kWh/month	174.5174	153.2266	159.5044	141.1688	137.6068	121.4582	114.1757	128.7033	129.5534	146.6688	157.1548	169.3908	(219)
Water heating fuel used												1733.1289	(219)
Annual totals kWh/year													
Space heating fuel - main system												1820.3048	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.1360, total flow = 29.0000, SFP = 0.2116)													
mechanical ventilation fans (SFP = 0.2116)												45.1040	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												120.1040	(231)
Electricity for lighting (calculated in Appendix L)												347.2353	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1029 * 1.00) =										-494.0096		-494.0096	(233)
Total delivered energy for all uses												3526.7633	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1820.3048	3.4800	63.3466	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1733.1289	3.4800	60.3129	(247)
Mechanical ventilation fans	45.1040	13.1900	5.9492	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	347.2353	13.1900	45.8003	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-494.0096	13.1900	-65.1599	(252)
Total energy cost			240.1417	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8832	(257)
SAP value		87.6796	
SAP rating (Section 12)		88	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1820.3048	0.2160	393.1858	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1733.1289	0.2160	374.3559	(264)
Space and water heating			767.5417	(265)
Pumps and fans	120.1040	0.5190	62.3340	(267)
Energy for lighting	347.2353	0.5190	180.2151	(268)
Energy saving/generation technologies				
PV Unit	-494.0096	0.5190	-256.3910	(269)
Total kg/year			753.6998	(272)
CO2 emissions per m2			10.8900	(273)
EI value			91.1562	
EI rating			91	(274)
EI band			B	

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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	$3.48 / 0.8846 = 3.934$, stars = 4
Water heating environmental impact	$0.216 / 0.8846 = 0.2442$, 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	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour	
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =												0.0000 / (5) =	0.0000 (8)
Pressure test											Yes		
Measured/design AP50											4.1000		
Infiltration rate											0.2050	(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) =		0.1743	(21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)	
Adj infilt rate	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)	
	0.2047	0.1917	0.1917	0.1743	0.1786	0.1699	0.1699	0.1655	0.1655	0.1786	0.1743	0.1786 (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
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			7.7000	1.3258	10.2083		(27)
ground			34.6000	0.1100	3.8060	75.0000	2594.9999 (28a)
external	43.9400	11.9000	32.0400	0.2700	8.6508	150.0000	4805.9998 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5111		(33)
party			80.8000	0.0000	0.0000	45.0000	3636.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13513.7998 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							195.2861 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4709 (36)
Total fabric heat loss						(33) + (36) =	38.9820 (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	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305 (38)
Heat transfer coeff	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125 (39)
Average = Sum(39)m / 12 =												67.8125 (39)
HLP	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799 (40)
HLP (average)												0.9799 (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	2.2265 (42)
Average daily hot water use (litres/day)	87.0805 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Calculation Type: New Build (As Built)

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

Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1370.1151 (45)
21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (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	14.0831	12.7005	14.0299	13.5417	13.9673	13.4869	13.9179	13.9499	13.5168	14.0040	13.5934	14.0728 (61)
Total heat required for water heating calculated for each month												
156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (64)	
Total per year (kWh/year) = Sum(64)m =												1534.9792 (64)
Heat gains from water heating, kWh/month												
50.7529	44.4847	46.1352	40.5493	39.1515	34.1433	31.9939	36.2081	36.4907	42.0892	45.5204	49.2600 (65)	

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.1548	43.6588	35.5057	26.8801	20.0932	16.9635	18.3297	23.8256	31.9787	40.6043	47.3912	50.5209 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6757	294.7024	287.0753	270.8380	250.3414	231.0774	218.2079	215.1812	222.8084	239.0456	259.5423	278.8062 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858 (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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Water heating gains (Table 5)	68.2163	66.1974	62.0097	56.3185	52.6229	47.4212	43.0025	48.6669	50.6815	56.5715	63.2228	66.2097 (72)
Total internal gains	507.1636	502.6754	482.7075	452.1534	421.1743	393.5789	377.6569	385.7905	403.5853	434.3382	468.2731	493.6536 (73)

6. Solar gains

[Jan]				Area	Solar flux	g		FF	Access		Gains	
				m2	Table 6a	Specific data		Specific data	factor		W	
					W/m2	or Table 6b		or Table 6c	Table 6d			
Southeast				4.4000	45.0642	0.4500		0.0000	0.7700		68.7048 (77)	
Northwest				3.3000	14.6130	0.4500		0.0000	0.7700		16.7093 (81)	

Solar gains	85.4141	128.7294	192.6372	262.0150	295.1900	333.3965	305.1898	276.8608	226.2256	157.3222	103.0133	68.5587 (83)
Total gains	592.5777	631.4048	675.3446	714.1684	716.3643	726.9754	682.8466	662.6513	629.8109	591.6605	571.2864	562.2124 (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	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561
alpha	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904
util living area												
	0.9684	0.9566	0.9217	0.8381	0.6881	0.4680	0.3265	0.3263	0.5793	0.8324	0.9412	0.9733 (86)
MIT	20.1979	20.2955	20.5120	20.7603	20.9271	20.9904	20.9986	20.9987	20.9746	20.8106	20.4831	20.1640 (87)
Th 2	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001 (88)
util rest of house												
	0.9609	0.9465	0.9035	0.8023	0.6267	0.3888	0.2381	0.2352	0.4956	0.7867	0.9251	0.9667 (89)
MIT 2	19.3944	19.4887	19.6952	19.9202	20.0562	20.0964	20.0998	20.0998	20.0888	19.9687	19.6716	19.3618 (90)
Living area fraction												
MIT	19.5674	19.6625	19.8711	20.1015	20.2438	20.2889	20.2934	20.2934	20.2796	20.1500	19.8463	19.5346 (91)
Temperature adjustment												
adjusted MIT	19.4174	19.5125	19.7211	19.9515	20.0938	20.1389	20.1434	20.1434	20.1296	20.0000	19.6963	19.3846 (92)
												-0.1500
												19.3846 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9537	0.9384	0.8945	0.7957	0.6263	0.3923	0.2424	0.2396	0.4985	0.7810	0.9164	0.9601	(94)
Useful gains	565.1615	592.5054	604.1266	568.2493	448.6521	285.2002	165.5260	158.7613	313.9350	462.0910	523.5410	539.7951	(95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W													
	936.9923	916.3134	821.9592	668.0565	474.2637	287.4504	165.6897	158.9104	320.7235	535.7200	752.4672	927.9834	(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													
	276.6421	217.5990	162.0675	71.8612	19.0550	0.0000	0.0000	0.0000	0.0000	54.7799	164.8268	288.8121	(98)
Space heating												1255.6437	(98)
Space heating per m2												(98) / (4) =	18.1451 (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 1387.4516 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	276.6421	217.5990	162.0675	71.8612	19.0550	0.0000	0.0000	0.0000	0.0000	54.7799	164.8268	288.8121	(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)	305.6819	240.4409	179.0801	79.4046	21.0553	0.0000	0.0000	0.0000	0.0000	60.5303	182.1291	319.1294	(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	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422	(64)
Efficiency of water heater (217)m	89.3188	89.2366	88.9756	88.4397	87.7214	87.3000	87.3000	87.3000	87.3000	88.2245	89.0001	89.3721	(217)
Fuel for water heating, kWh/month	174.8061	153.4570	159.8569	141.6930	138.1811	121.4582	114.1757	128.7033	129.5534	147.4179	157.6137	169.6751	(219)
Water heating fuel used												1736.5914	(219)
Annual totals kWh/year													
Space heating fuel - main system												1387.4516	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
 (MEVDecentralised, Database: total watage = 6.1360, total flow = 29.0000, SFP = 0.2116)
 mechanical ventilation fans (SFP = 0.2116) 45.1040 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 120.1040 (231)
 Electricity for lighting (calculated in Appendix L) 347.2353 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV Unit 0 (0.80 * 0.60 * 1154 * 1.00) = -554.1393 -554.1393 (233)
 Total delivered energy for all uses 3037.2430 (238)

10a. Fuel costs - using BEDF prices (514)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1387.4516	9.7400	135.1378	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1736.5914	9.7400	169.1440	(247)
Mechanical ventilation fans	45.1040	36.8500	16.6208	(249)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Energy for lighting	347.2353	36.8500	127.9562	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-554.1393	36.8500	-204.2003	(252)
Total energy cost			376.2960	(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	1387.4516	0.2160	299.6895	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1736.5914	0.2160	375.1037	(264)
Space and water heating			674.7933	(265)
Pumps and fans	120.1040	0.5190	62.3340	(267)
Energy for lighting	347.2353	0.5190	180.2151	(268)
Energy saving/generation technologies				
PV Unit	-554.1393	0.5190	-287.5983	(269)
Total kg/year			629.7441	(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	1387.4516	1.2200	1692.6909	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1736.5914	1.2200	2118.6415	(264)
Space and water heating			3811.3324	(265)
Pumps and fans	120.1040	3.0700	368.7192	(267)
Energy for lighting	347.2353	3.0700	1066.0124	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

PV Unit	-554.1393	3.0700	-1701.2076 (269)
Primary energy kWh/year			3544.8564 (272)
Primary energy kWh/m2/year			51.2262 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 91

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 74	-178 kg (28.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£74	2.57 kg/m²	B 89 A 93
Total Savings	£74	2.57 kg/m²	
Potential energy efficiency rating:			B 89
Potential environmental impact rating:			A 93

Fuel prices for cost data on this page from database revision number 514 TEST (30 Mar 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	£172	£191	-£18
Mains gas	£408	£316	£92
Space heating	£283	£283	£0
Water heating	£169	£96	£74
Lighting	£128	£128	£0
Generated (PV)	-£204	-£204	£0
Total cost of fuels	£376	£303	£74
Total cost of uses	£376	£303	£74
Delivered energy	44 kWh/m²	31 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.5 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	3 kg/m²
Primary energy	51 kWh/m²	37 kWh/m²	14 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															4.1000		
Infiltration rate															0.2050 (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) =					0.1743 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate																	
	0.2222	0.2178	0.2135	0.1917	0.1873	0.1655	0.1655	0.1612	0.1743	0.1873	0.1960	0.2047 (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
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			7.7000	1.3258	10.2083		(27)
ground			34.6000	0.1100	3.8060	75.0000	2594.9999 (28a)
external	43.9400	11.9000	32.0400	0.2700	8.6508	150.0000	4805.9998 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5111		(33)
party			80.8000	0.0000	0.0000	45.0000	3636.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13513.7998 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							195.2861 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4709 (36)
Total fabric heat loss						(33) + (36) =	38.9820 (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	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305 (38)
Heat transfer coeff	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125 (39)
Average = Sum(39)m / 12 =												67.8125 (39)
HLP	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799 (40)
HLP (average)												0.9799 (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 2.2265 (42)
Average daily hot water use (litres/day) 87.0805 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1370.1151 (45)
	21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (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	14.0831	12.7005	14.0299	13.5417	13.9673	13.4869	13.9179	13.9499	13.5168	14.0040	13.5934	14.0728 (61)
Total heat required for water heating calculated for each month	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3237 (H8)
Utilisation factor												0.5302 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.0805 (H14)
Volume ratio Veff/V												0.8613 (H15)
Solar storage volume factor												0.9701 (H16)
Solar input	-23.7860	-39.6920	-67.5999	-90.5973	-111.9253	-110.0404	-108.5861	-94.8723	-74.3040	-50.7409	-28.2136	-820.2625 (H17)
Solar input (sum of months) = Sum (63)m =												-19.9048 (63)
												-820.2625 (63)
Output from w/h	132.3488	97.2478	74.6337	34.7156	9.2891	0.0000	0.0000	17.4857	38.7961	79.3179	112.0627	131.7374 (64)
Total per year (kWh/year) = Sum (64)m =												727.6348 (64)
Heat gains from water heating, kWh/month	50.7529	44.4847	46.1352	40.5493	39.1515	34.1433	31.9939	36.2081	36.4907	42.0892	45.5204	49.2600 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.1548	43.6588	35.5057	26.8801	20.0932	16.9635	18.3297	23.8256	31.9787	40.6043	47.3912	50.5209 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6757	294.7024	287.0753	270.8380	250.3414	231.0774	218.2079	215.1812	222.8084	239.0456	259.5423	278.8062 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858 (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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Water heating gains (Table 5)	68.2163	66.1974	62.0097	56.3185	52.6229	47.4212	43.0025	48.6669	50.6815	56.5715	63.2228	66.2097 (72)
Total internal gains	507.1636	502.6754	482.7075	452.1534	421.1743	393.5789	377.6569	385.7905	403.5853	434.3382	468.2731	493.6536 (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
Southeast					4.4000	36.7938	0.4500		0.0000			56.0959 (77)
Northwest					3.3000	11.2829	0.4500		0.0000			12.9015 (81)

Solar gains	68.9974	121.8134	178.0530	239.6954	285.8933	291.4859	277.8358	242.1990	199.2156	137.6988	83.4233	58.5424 (83)
Total gains	576.1609	624.4888	660.7605	691.8488	707.0676	685.0649	655.4926	627.9895	602.8009	572.0370	551.6964	552.1960 (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	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561
alpha	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904
util living area	0.9789	0.9675	0.9433	0.8866	0.7741	0.6040	0.4489	0.4872	0.7069	0.8984	0.9647	0.9825 (86)
MIT	20.0308	20.1687	20.3862	20.6468	20.8579	20.9656	20.9930	20.9898	20.9287	20.6738	20.3003	19.9826 (87)
Th 2	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001 (88)
util rest of house	0.9741	0.9601	0.9302	0.8604	0.7253	0.5296	0.3601	0.3963	0.6361	0.8694	0.9554	0.9784 (89)
MIT 2	19.2302	19.3650	19.5756	19.8201	20.0033	20.0828	20.0979	20.0966	20.0601	19.8497	19.4957	19.1829 (90)
Living area fraction									fLA = Living area / (4) =			0.2153 (91)
MIT	19.4025	19.5380	19.7501	19.9981	20.1873	20.2729	20.2906	20.2889	20.2472	20.0271	19.6689	19.3551 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2525	19.3880	19.6001	19.8481	20.0373	20.1229	20.1406	20.1389	20.0972	19.8771	19.5189	19.2051 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9683	0.9529	0.9215	0.8520	0.7216	0.5316	0.3642	0.4003	0.6359	0.8610	0.9479	0.9732	(94)
Useful gains	557.8728	595.0923	608.8970	589.4727	510.2423	364.1929	238.7239	251.3841	383.3027	492.5480	522.9356	537.3763	(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	1013.9694	982.4678	888.3518	742.4156	565.3735	374.5201	240.0975	253.5440	406.6821	629.1034	842.1591	1017.5303	(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	339.3359	260.3164	207.9143	110.1189	41.0176	0.0000	0.0000	0.0000	0.0000	101.5972	229.8410	357.2345	(98)
Space heating												1647.3758	(98)
Space heating per m2											(98) / (4) =	23.8060	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1820.3048 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	339.3359	260.3164	207.9143	110.1189	41.0176	0.0000	0.0000	0.0000	0.0000	101.5972	229.8410	357.2345	(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)	374.9568	287.6424	229.7396	121.6783	45.3233	0.0000	0.0000	0.0000	0.0000	112.2621	253.9679	394.7343	(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	132.3488	97.2478	74.6337	34.7156	9.2891	0.0000	0.0000	17.4857	38.7961	79.3179	112.0627	131.7374	(64)
Efficiency of water heater	(217)m	89.5787	89.6322	89.7118	89.8916	87.3000	87.3000	87.3000	87.3000	89.0686	89.4256	87.3000	(216)
Fuel for water heating, kWh/month	147.7458	108.5274	83.2667	38.6968	10.3336	0.0000	0.0000	20.0294	44.4400	89.0525	125.3139	147.0038	(219)
Water heating fuel used												814.4100	(219)
Annual totals kWh/year													
Space heating fuel - main system												1820.3048	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.1360, total flow = 29.0000, SFP = 0.2116)													
mechanical ventilation fans (SFP = 0.2116)													45.1040 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													170.1040 (231)
Electricity for lighting (calculated in Appendix L)													347.2353 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1029 * 1.00) =										-494.0096		-494.0096	(233)
Total delivered energy for all uses												2658.0444	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1820.3048	3.4800	63.3466	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	814.4100	3.4800	28.3415	(247)
Mechanical ventilation fans	45.1040	13.1900	5.9492	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	347.2353	13.1900	45.8003	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-494.0096	13.1900	-65.1599	(252)
Total energy cost			214.7653	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7899 (257)
SAP value		88.9815
SAP rating (Section 12)		89 (258)
SAP band		B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	1820.3048	0.2160	393.1858	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	814.4100	0.2160	175.9126	(264)
Space and water heating			569.0984	(265)
Pumps and fans	170.1040	0.5190	88.2840	(267)
Energy for lighting	347.2353	0.5190	180.2151	(268)
Energy saving/generation technologies				
PV Unit	-494.0096	0.5190	-256.3910	(269)
Total kg/year			581.2065	(272)
CO2 emissions per m2			8.4000	(273)
EI value			93.1802	
EI rating			93	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											4.1000	
Infiltration rate											0.2050 (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) =	0.1743 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate												
	0.2047	0.1917	0.1917	0.1743	0.1786	0.1699	0.1699	0.1655	0.1655	0.1786	0.1743	0.1786 (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
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			7.7000	1.3258	10.2083		(27)
ground			34.6000	0.1100	3.8060	75.0000	2594.9999 (28a)
external	43.9400	11.9000	32.0400	0.2700	8.6508	150.0000	4805.9998 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5111		(33)
party			80.8000	0.0000	0.0000	45.0000	3636.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13513.7998 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							195.2861 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4709 (36)
Total fabric heat loss						(33) + (36) =	38.9820 (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	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305 (38)
Heat transfer coeff	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125	67.8125 (39)
Average = Sum(39)m / 12 =												67.8125 (39)
HLP	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799	0.9799 (40)
HLP (average)												0.9799 (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	2.2265 (42)
Average daily hot water use (litres/day)	87.0805 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1370.1151 (45)
	21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (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	14.0831	12.7005	14.0299	13.5417	13.9673	13.4869	13.9179	13.9499	13.5168	14.0040	13.5934	14.0728 (61)
Total heat required for water heating calculated for each month	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.4788 (H8)
Utilisation factor												0.4915 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.0805 (H14)
Volume ratio Veff/V												0.8613 (H15)
Solar storage volume factor												0.9701 (H16)
Solar input	-27.7177	-39.4176	-68.3998	-92.0092	-106.9209	-116.2989	-110.2691	-100.5548	-78.7040	-54.3974	-32.7837	-849.4204 (H17)
Solar input (sum of months) = Sum (63)m =												-21.9473 (63)
Output from w/h	128.4171	97.5221	73.8339	33.3037	14.2934	0.0000	0.0000	11.8032	34.3961	75.6614	107.4926	129.6950 (64)
Total per year (kWh/year) = Sum (64)m =												706.4185 (64)
Heat gains from water heating, kWh/month	50.7529	44.4847	46.1352	40.5493	39.1515	34.1433	31.9939	36.2081	36.4907	42.0892	45.5204	49.2600 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.1548	43.6588	35.5057	26.8801	20.0932	16.9635	18.3297	23.8256	31.9787	40.6043	47.3912	50.5209 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6757	294.7024	287.0753	270.8380	250.3414	231.0774	218.2079	215.1812	222.8084	239.0456	259.5423	278.8062 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858 (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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Water heating gains (Table 5)	68.2163	66.1974	62.0097	56.3185	52.6229	47.4212	43.0025	48.6669	50.6815	56.5715	63.2228	66.2097 (72)
Total internal gains	507.1636	502.6754	482.7075	452.1534	421.1743	393.5789	377.6569	385.7905	403.5853	434.3382	468.2731	493.6536 (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	
Southeast					4.4000	45.0642	0.4500		0.0000			0.7700			68.7048 (77)
Northwest					3.3000	14.6130	0.4500		0.0000			0.7700			16.7093 (81)

Solar gains	85.4141	128.7294	192.6372	262.0150	295.1900	333.3965	305.1898	276.8608	226.2256	157.3222	103.0133			68.5587 (83)	
Total gains	592.5777	631.4048	675.3446	714.1684	716.3643	726.9754	682.8466	662.6513	629.8109	591.6605	571.2864			562.2124 (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	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561	55.3561
alpha	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904	4.6904
util living area	0.9684	0.9566	0.9217	0.8381	0.6881	0.4680	0.3265	0.3263	0.5793	0.8324	0.9412	0.9733 (86)
MIT	20.1979	20.2955	20.5120	20.7603	20.9271	20.9904	20.9986	20.9987	20.9746	20.8106	20.4831	20.1640 (87)
Th 2	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001	20.1001 (88)
util rest of house	0.9609	0.9465	0.9035	0.8023	0.6267	0.3888	0.2381	0.2352	0.4956	0.7867	0.9251	0.9667 (89)
MIT 2	19.3944	19.4887	19.6952	19.9208	20.0562	20.0964	20.0998	20.0998	20.0888	19.9687	19.6716	19.3618 (90)
Living area fraction									fLA = Living area / (4) =			0.2153 (91)
MIT	19.5674	19.6625	19.8711	20.1015	20.2438	20.2889	20.2934	20.2934	20.2796	20.1500	19.8463	19.5346 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.4174	19.5125	19.7211	19.9515	20.0938	20.1389	20.1434	20.1434	20.1296	20.0000	19.6963	19.3846 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9537	0.9384	0.8945	0.7957	0.6263	0.3923	0.2424	0.2396	0.4985	0.7810	0.9164	0.9601	(94)
Useful gains	565.1615	592.5054	604.1266	568.2493	448.6521	285.2002	165.5260	158.7613	313.9350	462.0910	523.5410	539.7951	(95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W	936.9923	916.3134	821.9592	668.0565	474.2637	287.4504	165.6897	158.9104	320.7235	535.7200	752.4672	927.9834	(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	276.6421	217.5990	162.0675	71.8612	19.0550	0.0000	0.0000	0.0000	0.0000	54.7799	164.8268	288.8121	(98)
Space heating												1255.6437	(98)
Space heating per m2											(98) / (4) =	18.1451	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													1387.4516	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	276.6421	217.5990	162.0675	71.8612	19.0550	0.0000	0.0000	0.0000	0.0000	54.7799	164.8268	288.8121	(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)	305.6819	240.4409	179.0801	79.4046	21.0553	0.0000	0.0000	0.0000	0.0000	60.5303	182.1291	319.1294	(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	128.4171	97.5221	73.8339	33.3037	14.2934	0.0000	0.0000	11.8032	34.3961	75.6614	107.4926	129.6950	(64)	
Efficiency of water heater	89.4604	89.4849	89.4735	89.4615	89.1002	87.3000	87.3000	87.3000	87.3000	88.6159	89.2092	87.3000	(216)	
(217)m	89.4604	89.4849	89.4735	89.4615	89.1002	87.3000	87.3000	87.3000	87.3000	88.6159	89.2092	89.4835	(217)	
Fuel for water heating, kWh/month	143.5463	108.9817	82.5204	37.2268	16.0420	0.0000	0.0000	13.5202	39.3999	85.3813	120.4950	144.9373	(219)	
Water heating fuel used												792.0508	(219)	
Annual totals kWh/year														
Space heating fuel - main system												1387.4516	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 6.1360, total flow = 29.0000, SFP = 0.2116)														
mechanical ventilation fans (SFP = 0.2116)													45.1040	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													170.1040	(231)
Electricity for lighting (calculated in Appendix L)													347.2353	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
PV Unit 0 (0.80 * 0.60 * 1154 * 1.00) =										-554.1393		-554.1393	(233)	
Total delivered energy for all uses												2142.7024	(238)	

10a. Fuel costs - using BEDF prices (514)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1387.4516	9.7400	135.1378	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	792.0508	9.7400	77.1457	(247)
Mechanical ventilation fans	45.1040	36.8500	16.6208	(249)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	347.2353	36.8500	127.9562	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-554.1393	36.8500	-204.2003	(252)
Total energy cost			302.7227	(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	1387.4516	0.2160	299.6895	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	792.0508	0.2160	171.0830	(264)
Space and water heating			470.7725	(265)
Pumps and fans	170.1040	0.5190	88.2840	(267)

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Energy for lighting	347.2353	0.5190	180.2151 (268)
Energy saving/generation technologies			
PV Unit	-554.1393	0.5190	-287.5983 (269)
Total kg/year			451.6733 (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	1387.4516	1.2200	1692.6909 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	792.0508	1.2200	966.3020 (264)
Space and water heating			2658.9929 (265)
Pumps and fans	170.1040	3.0700	522.2192 (267)
Energy for lighting	347.2353	3.0700	1066.0124 (268)
Energy saving/generation technologies			
PV Unit	-554.1393	3.0700	-1701.2076 (269)
Primary energy kWh/year			2546.0169 (272)
Primary energy kWh/m2/year			36.7922 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	195.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	230.64 (P1)
Transmission heat loss coefficient	38.98 (37)
Summer heat loss coefficient	269.63 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	4.4000	127.3119	0.4500	0.0000	0.9000	226.8697
North West	3.3000	106.0502	0.4500	0.0000	0.9000	141.7361
total:						368.6058

	Jun	Jul	Aug	
Solar gains	396	369	327	(P4)
Internal gains	391	375	383	
Total summer gains	787	743	710	(P5)

Summer gain/loss ratio	2.92	2.76	2.63	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 195.3)	0.63	0.63	0.63	
Threshold temperature	18.95	20.69	20.57	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 84	Issued on Date	27/04/2023
Assessment Reference	84 Hamlewood	Prop Type Ref	21809
Property	2 Hickory Way, HEDGE END, SO30 0AW		
SAP Rating	88 B	DER	12.89
Environmental	91 B	TER	18.23
CO ₂ Emissions (t/year)	0.63	% DER<TER	29.28
General Requirements Compliance	Pass	DfEE	38.64
		TfEE	45.93
		% DfEE<TfEE	15.88
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk		Assessor ID
			Y128-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TfEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.23	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.89	kgCO ₂ /m ²	Pass
	-5.34 (-29.3%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	45.93	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	38.64	kWh/m ² /yr	
	-7.3 (-15.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.10 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.1600 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing South East

4.40 m², No overhang

Windows facing North West

3.30 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.10 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Floor U-value

0.11

W/m²K

Door U-value

1.00

W/m²K

Photovoltaic array

0.60

kW

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.