

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 21 Hamblewood			Issued on Date	18/05/2023
Assessment Reference	21 Hamblewood	Prop Type Ref	21809		
Property	40 Alder Avenue, Hedge End, Southampton, SO30 0AS				
SAP Rating	88 B	DER	13.13	TER	16.29
Environmental	89 B	% DER<TER	19.40		
CO ₂ Emissions (t/year)	0.96	DFEE	42.89	TFEE	47.07
General Requirements Compliance	Pass	% DFEE<TFEE	8.88		
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

Semi-Detached House, total floor area 102 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.29 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.13 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 47.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 42.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.33 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.15 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.36 (max. 2.00)	1.70 (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:	4.32 (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 North East: 7.15 m², No overhang

Windows facing South East: 1.90 m², No overhang

Windows facing South West: 5.45 m², No overhang

Air change rate: 0.00 ach

Blinds/curtains: None

10 Key features

External wall U-value 0.13 W/m²K

Party wall U-value 0.00 W/m²K

Roof U-value 0.11 W/m²K

Floor U-value 0.12 W/m²K

Door U-value 1.00 W/m²K

Photovoltaic array 0.90 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	35.5000 (1b)	x 2.4500 (2b)	= 86.9750 (1b) - (3b)
First floor	35.5000 (1c)	x 2.6000 (2c)	= 92.3000 (1c) - (3c)
Second floor	31.1000 (1d)	x 1.9500 (2d)	= 60.6450 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.9200 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							4.3200					
Infiltration rate							0.2160	(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) =	0.1836 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2341	0.2295	0.2249	0.2020	0.1974	0.1744	0.1744	0.1698	0.1836	0.1974	0.2066	0.2157 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K		
entrance			2.1000	1.0000	2.1000			(26)	
front (Uw = 1.40)			14.5000	1.3258	19.2235			(27)	
rear (Uw = 1.70)			0.5400	1.5918	0.8596			(27a)	
ground			35.5000	0.1200	4.2600	75.0000	2662.5000	(28a)	
external	99.0500	15.2000	83.8500	0.2700	22.6395	150.0000	12577.5004	(29a)	
dormer	3.3000	1.4000	1.9000	0.3300	0.6270	9.0000	17.1000	(29a)	
stud in roof	5.2800		5.2800	0.1300	0.6864	9.0000	47.5200	(29a)	
cold	13.1000		13.1000	0.1100	1.4410	9.0000	117.9000	(30)	
dormer	2.1000		2.1000	0.2000	0.4200	9.0000	18.9000	(30)	
sloped	21.8300	0.5400	21.2900	0.1800	3.8322	9.0000	191.6100	(30)	
cold	4.4000		4.4000	0.1300	0.5720	9.0000	39.6000	(30)	
Total net area of external elements Aum(A, m2)			184.5600						(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.6611			(33)	
party			54.1000	0.0000	0.0000	45.0000	2434.4999	(32)	
stud			141.2000			9.0000	1270.8000	(32c)	
internal			66.6000			18.0000	1198.8000	(32d)	
internal			66.6000			9.0000	599.4000	(32e)	
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				21176.1303	(34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							207.4058	(35)	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5454	(36)	
Total fabric heat loss			(33) + (36) =				66.2065	(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	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868 (38)
Heat transfer coeff	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933 (39)
Average = Sum(39)m / 12 =												105.7933 (39)
HLP	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362 (40)
HLP (average)												1.0362 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Assumed occupancy												2.7581 (42)
Average daily hot water use (litres/day)												99.7057 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.6763	105.6880	101.6998	97.7116	93.7233	89.7351	89.7351	93.7233	97.7116	101.6998	105.6880	109.6763 (44)
Energy conte	162.6467	142.2519	146.7912	127.9761	122.7961	105.9637	98.1910	112.6756	114.0213	132.8808	145.0498	157.5147 (45)
Energy content (annual)												Total = Sum(45)m = 1568.7586 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3970	21.3378	22.0187	19.1964	18.4194	15.8946	14.7286	16.9013	17.1032	19.9321	21.7575	23.6272 (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	14.1469	12.7667	14.1089	13.6129	14.0328	13.5410	13.9680	14.0100	13.5802	14.0755	13.6609	14.1346 (61)
Total heat required for water heating calculated for each month	176.7936	155.0185	160.9000	141.5890	136.8289	119.5047	112.1590	126.6856	127.6014	146.9563	158.7107	171.6493 (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	176.7936	155.0185	160.9000	141.5890	136.8289	119.5047	112.1590	126.6856	127.6014	146.9563	158.7107	171.6493 (64)
Heat gains from water heating, kWh/month	57.6168	50.4904	52.3353	45.9553	44.3379	38.6182	36.1405	40.9671	41.3071	47.7017	51.6443	55.9073 (65)
												Total per year (kWh/year) = Sum(64)m = 1734.3970 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.5280	21.7855	17.7172	13.4130	10.0264	8.4647	9.1464	11.8889	15.9572	20.2614	23.6480	25.2097 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.6787	262.3733	255.5829	241.1269	222.8787	205.7280	194.2703	191.5757	198.3661	212.8221	231.0703	248.2210 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907 (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)	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254 (71)
Water heating gains (Table 5)	77.4419	75.1345	70.3431	63.8268	59.5940	53.6364	48.5759	55.0633	57.3710	64.1152	71.7282	75.1442 (72)
Total internal gains	429.0205	426.6654	411.0152	385.7387	359.8711	335.2011	319.3647	325.8999	339.0663	364.5707	393.8184	415.9468 (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	
Northeast					7.1500	11.2829	0.4500	0.0000	0.7700		27.9532 (75)	
Southeast					1.9000	36.7938	0.4500	0.0000	0.7700		24.2232 (77)	
Southwest					5.4500	36.7938	0.4500	0.0000	0.7700		69.4824 (79)	
Northeast					0.5400	16.3666	0.6300	0.7000	1.0000		3.5078 (82)	
Solar gains	125.1666	223.7344	334.2233	461.4352	560.1904	575.2469	546.6447	470.0200	377.7979	254.8379	151.8350	105.8796 (83)
Total gains	554.1871	650.3998	745.2385	847.1739	920.0615	910.4481	866.0094	795.9199	716.8642	619.4086	545.6535	521.8264 (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	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014
alpha	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068
util living area	0.9971	0.9933	0.9825	0.9465	0.8512	0.6857	0.5237	0.5865	0.8322	0.9696	0.9941	0.9978 (86)
MIT	19.6776	19.8486	20.1268	20.4791	20.7814	20.9425	20.9870	20.9784	20.8547	20.4558	19.9892	19.6314 (87)
Th 2	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533 (88)
util rest of house	0.9962	0.9914	0.9774	0.9302	0.8077	0.6044	0.4176	0.4771	0.7675	0.9573	0.9921	0.9972 (89)
MIT 2	18.8395	19.0096	19.2850	19.6264	19.9002	20.0243	20.0493	20.0460	19.9666	19.6099	19.1504	18.7934 (90)
Living area fraction	18.9577	19.1279	19.4037	19.7467	20.0245	20.1538	20.1816	20.1775	20.0918	19.7292	19.2687	18.9116 (92)
Temperature adjustment	18.8077	18.9779	19.2537	19.5967	19.8745	20.0038	20.0316	20.0275	19.9418	19.5792	19.1187	-0.1500
adjusted MIT	1534.8178	1489.3520	1349.2560	1131.6386	864.8088	571.6830	363.0362	383.7609	618.0281	949.9384	1271.4955	1540.5169 (97)

8. Space heating requirement

Utilisation	0.9947	0.9885	0.9717	0.9204	0.7983	0.5998	0.4151	0.4740	0.7586	0.9491	0.9893	0.9959 (94)
Useful gains	551.2486	642.9146	724.1143	779.7403	734.4790	546.0855	359.4891	377.2458	543.8120	587.8622	539.7964	519.7082 (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	1534.8178	1489.3520	1349.2560	1131.6386	864.8088	571.6830	363.0362	383.7609	618.0281	949.9384	1271.4955	1540.5169 (97)

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Month fraction	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	731.7755	568.8060	465.1054	253.3668	96.9653	0.0000	0.0000	0.0000	0.0000	269.3847	526.8234	759.4816 (98)
Space heating												3671.7087 (98)
Space heating per m2										(98) / (4) =		35.9619 (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												4057.1367 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	731.7755	568.8060	465.1054	253.3668	96.9653	0.0000	0.0000	0.0000	0.0000	269.3847	526.8234	759.4816 (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)	808.5917	628.5149	513.9286	279.9633	107.1440	0.0000	0.0000	0.0000	0.0000	297.6627	582.1253	839.2062 (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	176.7936	155.0185	160.9000	141.5890	136.8289	119.5047	112.1590	126.6856	127.6014	146.9563	158.7107	171.6493 (64)
Efficiency of water heater	89.8591	89.7951	89.6553	89.3262	88.5993	87.3000	87.3000	87.3000	87.3000	89.3440	89.7385	87.3000 (216)
Fuel for water heating, kWh/month	196.7454	172.6359	179.4651	158.5078	154.4356	136.8897	128.4754	145.1152	146.1643	164.4835	176.8592	190.9493 (219)
Water heating fuel used												1950.7264 (219)
Annual totals kWh/year												
Space heating fuel - main system												4057.1367 (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)												61.9318 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												136.9318 (231)
Electricity for lighting (calculated in Appendix L)												433.1717 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.90 * 677 * 1.00) =										-487.0835		-487.0835 (233)
Total delivered energy for all uses												6090.8832 (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	4057.1367	0.2160	876.3415 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1950.7264	0.2160	421.3569 (264)
Space and water heating			1297.6984 (265)
Pumps and fans	136.9318	0.5190	71.0676 (267)
Energy for lighting	433.1717	0.5190	224.8161 (268)
Energy saving/generation technologies			
PV Unit	-487.0835	0.5190	-252.7963 (269)
Total CO2, kg/year			1340.7858 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.1300 (273)

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

DER			13.1300 ZC1
Total Floor Area		TFA	102.1000
Assumed number of occupants		N	2.7581
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.0715 ZC2
CO2 emissions from cooking, equation (L16)			1.8139 ZC3
Total CO2 emissions			30.0154 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			30.0154 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	35.5000 (1b)	x 2.4500 (2b)	= 86.9750 (1b) - (3b)
First floor	35.5000 (1c)	x 2.6000 (2c)	= 92.3000 (1c) - (3c)
Second floor	31.1000 (1d)	x 1.9500 (2d)	= 60.6450 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.9200 (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											4 * 10 =	40.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =	0.1667 (8)	
Pressure test										Yes		
Measured/design AP50											5.0000	
Infiltration rate											0.4167 (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) =	0.3542 (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	0.4516	0.4428	0.4339	0.3896	0.3808	0.3365	0.3365	0.3276	0.3542	0.3808	0.3985	0.4162 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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 Opening Type (Uw = 1.40)			14.5000	1.3258	19.2235		(27)
TER Room Window (Uw = 1.70)			0.5400	1.5918	0.8596		(27a)
ground			35.5000	0.1300	4.6150		(28a)
external	99.0500	15.2000	83.8500	0.1800	15.0930		(29a)
dormer	3.3000	1.4000	1.9000	0.1800	0.3420		(29a)
stud in roof	5.2800		5.2800	0.1800	0.9504		(29a)
cold	13.1000		13.1000	0.1300	1.7030		(30)
dormer	2.1000		2.1000	0.1300	0.2730		(30)
sloped	21.8300	0.5400	21.2900	0.1300	2.7677		(30)
cold	4.4000		4.4000	0.1300	0.5720		(30)
Total net area of external elements Aum(A, m ²)			184.5600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.4991		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7050 (36)
Total fabric heat loss						(33) + (36) =	59.2041 (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	47.6610	47.3475	47.0402	45.5967	45.3266	44.0694	44.0694	43.8366	44.5537	45.3266	45.8730	46.4442 (38)
Heat transfer coeff	106.8652	106.5516	106.2443	104.8008	104.5308	103.2735	103.2735	103.0407	103.7578	104.5308	105.0771	105.6483 (39)
Average = Sum(39)m / 12 =												104.7995 (39)
HLP	1.0467	1.0436	1.0406	1.0265	1.0238	1.0115	1.0115	1.0092	1.0162	1.0238	1.0292	1.0348 (40)
HLP (average)												1.0264 (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												2.7581 (42)
Average daily hot water use (litres/day)												99.7057 (43)
Daily hot water use	Jan 109.6763	Feb 105.6880	Mar 101.6998	Apr 97.7116	May 93.7233	Jun 89.7351	Jul 89.7351	Aug 93.7233	Sep 97.7116	Oct 101.6998	Nov 105.6880	Dec 109.6763 (44)
Energy conte	162.6467	142.2519	146.7912	127.9761	122.7961	105.9637	98.1910	112.6756	114.0213	132.8808	145.0498	157.5147 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1568.7586 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3970	21.3378	22.0187	19.1964	18.4194	15.8946	14.7286	16.9013	17.1032	19.9321	21.7575	23.6272 (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	50.9589	46.0274	50.9589	48.1865	47.7604	44.2529	45.7280	47.7604	48.1865	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	213.6056	188.2792	197.7501	176.1626	170.5565	150.2166	143.9190	160.4359	162.2078	183.8397	194.3648	208.4736 (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	213.6056	188.2792	197.7501	176.1626	170.5565	150.2166	143.9190	160.4359	162.2078	183.8397	194.3648	208.4736 (64)
	Total per year (kWh/year) = Sum(64)m = 2149.8115 (64)											
Heat gains from water heating, kWh/month	66.8198	58.8056	61.5478	54.5987	52.7698	46.2962	44.0805	49.4047	49.9587	56.9226	60.5578	65.1133 (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	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.5280	21.7855	17.7172	13.4130	10.0264	8.4647	9.1464	11.8889	15.9572	20.2614	23.6480	25.2097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.6787	262.3733	255.5829	241.1269	222.8787	205.7280	194.2703	191.5757	198.3661	212.8221	231.0703	248.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	(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)	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	(71)
Water heating gains (Table 5)	89.8115	87.5083	82.7255	75.8315	70.9272	64.3002	59.2480	66.4042	69.3871	76.5089	84.1081	87.5179	(72)
Total internal gains	441.3902	439.0392	423.3976	397.7434	371.2043	345.8650	330.0367	337.2407	351.0824	376.9643	406.1984	428.3206	(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			
Northeast				7.1500	11.2829	0.6300	0.7000	0.7700	24.6547 (75)			
Southeast				1.9000	36.7938	0.6300	0.7000	0.7700	21.3649 (77)			
Southwest				5.4500	36.7938	0.6300	0.7000	0.7700	61.2835 (79)			
Northeast				0.5400	16.3666	0.6300	0.7000	1.0000	3.5078 (82)			
Solar gains	110.8109	198.1856	296.3563	409.6382	497.7211	511.2710	485.7800	417.4168	335.1540	225.8165	134.4406	93.7232 (83)
Total gains	552.2010	637.2248	719.7539	807.3816	868.9254	857.1360	815.8167	754.6575	686.2364	602.7808	540.6390	522.0438 (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	66.3479	66.5431	66.7356	67.6548	67.8296	68.6553	68.6553	68.8105	68.3349	67.8296	67.4769	67.1121
alpha	5.4232	5.4362	5.4490	5.5103	5.5220	5.5770	5.5770	5.5874	5.5557	5.5220	5.4985	5.4741
util living area	0.9988	0.9971	0.9915	0.9681	0.8899	0.7205	0.5473	0.6099	0.8648	0.9825	0.9973	0.9991 (86)
MIT	19.8440	19.9868	20.2239	20.5422	20.8128	20.9591	20.9926	20.9870	20.8845	20.5341	20.1334	19.8224 (87)
Th 2	20.0446	20.0472	20.0496	20.0613	20.0635	20.0738	20.0738	20.0757	20.0698	20.0635	20.0591	20.0545 (88)
util rest of house	0.9984	0.9961	0.9884	0.9559	0.8492	0.6360	0.4372	0.4965	0.8009	0.9736	0.9962	0.9988 (89)
MIT 2	18.4913	18.7019	19.0487	19.5129	19.8756	20.0459	20.0709	20.0701	19.9734	19.5087	18.9252	18.4670 (90)
Living area fraction	fLA = Living area / (4) = 0.1410 (91)											
MIT	18.6821	18.8831	19.2145	19.6580	20.0078	20.1747	20.2009	20.1994	20.1019	19.6533	19.0956	18.6582 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.6821	18.8831	19.2145	19.6580	20.0078	20.1747	20.2009	20.1994	20.1019	19.6533	19.0956	18.6582 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9975	0.9943	0.9846	0.9491	0.8464	0.6458	0.4527	0.5123	0.8035	0.9682	0.9945	0.9982	(94)	
Useful gains	550.8256	633.6065	708.6787	766.3084	735.4790	553.5590	369.3321	386.6127	551.3899	583.6404	537.6877	521.0798	(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	1536.9472	1489.9215	1350.8382	1127.4522	868.4157	575.7144	371.8776	391.4916	622.7484	946.3515	1260.4660	1527.4827	(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	733.6745	575.4437	477.7667	260.0235	98.9049	0.0000	0.0000	0.0000	0.0000	269.8571	520.4004	748.7638	(98)	
Space heating												3684.8345	(98)	
Space heating per m2												(98) / (4) =	36.0904	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 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 %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3945.2190 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	733.6745	575.4437	477.7667	260.0235	98.9049	0.0000	0.0000	0.0000	0.0000	269.8571	520.4004	748.7638 (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)	785.5187	616.1067	511.5275	278.3978	105.8939	0.0000	0.0000	0.0000	0.0000	288.9262	557.1739	801.6743 (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	213.6056	188.2792	197.7501	176.1626	170.5565	150.2166	143.9190	160.4359	162.2078	183.8397	194.3648	208.4736 (64)
Efficiency of water heater (217)m	87.9068	87.6812	87.1897	86.0298	83.7338	80.3000	80.3000	80.3000	80.3000	86.0161	87.4103	80.3000 (216)
Fuel for water heating, kWh/month	242.9911	214.7316	226.8045	204.7692	203.6890	187.0693	179.2266	199.7957	202.0022	213.7270	222.3591	236.9295 (219)
Water heating fuel used												2534.0948 (219)
Annual totals kWh/year												
Space heating fuel - main system												3945.2190 (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)												433.1717 (232)
Total delivered energy for all uses												6987.4855 (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	3945.2190	0.2160	852.1673 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	2534.0948	0.2160	547.3645 (264)	
Space and water heating			1399.5318 (265)	
Pumps and fans	75.0000	0.5190	38.9250 (267)	
Energy for lighting	433.1717	0.5190	224.8161 (268)	
Total CO2, kg/m2/year			1663.2729 (272)	
Emissions per m2 for space and water heating			13.7075 (272a)	
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2019 (272b)	
Emissions per m2 for pumps and fans			0.3812 (272c)	
Target Carbon Dioxide Emission Rate (TER) = (13.7075 * 1.00) + 2.2019 + 0.3812, rounded to 2 d.p.			16.2900 (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	35.5000 (1b)	x 2.4500 (2b)	= 86.9750 (1b) - (3b)
First floor	35.5000 (1c)	x 2.6000 (2c)	= 92.3000 (1c) - (3c)
Second floor	31.1000 (1d)	x 1.9500 (2d)	= 60.6450 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.9200 (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												4 * 10 =	40.0000	(7a)	
Number of passive vents												0 * 10 =	0.0000	(7b)	
Number of flueless gas fires												0 * 40 =	0.0000	(7c)	
												Air changes per hour			
Infiltration due to chimneys, flues and fans						= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000	/ (5) =	0.1667	(8)
Pressure test												Yes			
Measured/design AP50												4.3200			
Infiltration rate												0.3827			(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) =						0.3253			(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	0.4148	0.4066	0.3985	0.3578	0.3497	0.3090	0.3090	0.3009	0.3253	0.3497	0.3660	0.3822	(22b)		
Effective ac	0.5860	0.5827	0.5794	0.5640	0.5611	0.5478	0.5478	0.5453	0.5529	0.5611	0.5670	0.5731	(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)
front (Uw = 1.40)			14.5000	1.3258	19.2235		(27)
rear (Uw = 1.70)			0.5400	1.5918	0.8596		(27a)
ground			35.5000	0.1200	4.2600	75.0000	2662.5000 (28a)
external	99.0500	15.2000	83.8500	0.2700	22.6395	150.0000	12577.5004 (29a)
dormer	3.3000	1.4000	1.9000	0.3300	0.6270	9.0000	17.1000 (29a)
stud in roof	5.2800		5.2800	0.1300	0.6864	9.0000	47.5200 (29a)
cold	13.1000		13.1000	0.1100	1.4410	9.0000	117.9000 (30)
dormer	2.1000		2.1000	0.2000	0.4200	9.0000	18.9000 (30)
sloped	21.8300	0.5400	21.2900	0.1800	3.8322	9.0000	191.6100 (30)
cold	4.4000		4.4000	0.1300	0.5720	9.0000	39.6000 (30)
Total net area of external elements Aum(A, m ²)			184.5600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.6611		(33)
party			54.1000	0.0000	0.0000	45.0000	2434.4999 (32)
stud			141.2000			9.0000	1270.8000 (32c)
internal			66.6000			18.0000	1198.8000 (32d)
internal			66.6000			9.0000	599.4000 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				21176.1303 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							207.4058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5454 (36)
Total fabric heat loss			(33) + (36) =				66.2065 (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	46.3973	46.1328	45.8736	44.6560	44.4282	43.3678	43.3678	43.1714	43.7762	44.4282	44.8891	45.3708 (38)
Heat transfer coeff	112.6038	112.3393	112.0801	110.8626	110.6348	109.5743	109.5743	109.3779	109.9828	110.6348	111.0956	111.5774 (39)
Average = Sum(39)m / 12 =												110.8615 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1029	1.1003	1.0977	1.0858	1.0836	1.0732	1.0732	1.0713	1.0772	1.0836	1.0881	1.0928 (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	2.7581 (42)
Average daily hot water use (litres/day)	99.7057 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.6763	105.6880	101.6998	97.7116	93.7233	89.7351	89.7351	93.7233	97.7116	101.6998	105.6880	109.6763	(44)
Energy conte	162.6467	142.2519	146.7912	127.9761	122.7961	105.9637	98.1910	112.6756	114.0213	132.8808	145.0498	157.5147	(45)
Energy content (annual)	Total = Sum (45)m = 1568.7586 (45)												
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	34.5624	30.2285	31.1931	27.1949	26.0942	22.5173	20.8656	23.9436	24.2295	28.2372	30.8231	33.4719	(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	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.5280	21.7855	17.7172	13.4130	10.0264	8.4647	9.1464	11.8889	15.9572	20.2614	23.6480	25.2097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.6787	262.3733	255.5829	241.1269	222.8787	205.7280	194.2703	191.5757	198.3661	212.8221	231.0703	248.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	(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)	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	(71)
Water heating gains (Table 5)	46.4549	44.9829	41.9262	37.7707	35.0728	31.2740	28.0451	32.1822	33.6521	37.9532	42.8098	44.9891	(72)
Total internal gains	395.0335	393.5138	379.5983	356.6826	332.3499	309.8388	295.8339	300.0187	312.3474	335.4087	361.9001	382.7917	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		Specific data or Table 6c	FF	Access factor Table 6d		Gains W	
Northeast				7.1500	11.2829	0.4500			0.0000	0.7700		27.9532 (75)	
Southeast				1.9000	36.7938	0.4500			0.0000	0.7700		24.2232 (77)	
Southwest				5.4500	36.7938	0.4500			0.0000	0.7700		69.4824 (79)	
Northeast				0.5400	16.3666	0.6300			0.7000	1.0000		3.5078 (82)	
Solar gains	125.1666	223.7344	334.2233	461.4352	560.1904	575.2469	546.6447	470.0200	377.7979	254.8379	151.8350	105.8796 (83)	
Total gains	520.2001	617.2482	713.8217	818.1178	892.5403	885.0857	842.4785	770.0388	690.1454	590.2466	513.7351	488.6713 (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	52.2385	52.3615	52.4826	53.0590	53.1683	53.6828	53.6828	53.7792	53.4835	53.1683	52.9477	52.7191	
alpha	4.4826	4.4908	4.4988	4.5373	4.5446	4.5789	4.5789	4.5853	4.5656	4.5446	4.5298	4.5146	
util living area	0.9977	0.9947	0.9860	0.9558	0.8726	0.7144	0.5524	0.6179	0.8570	0.9760	0.9954	0.9983	(86)
MIT	19.5382	19.7166	20.0097	20.3971	20.7304	20.9255	20.9819	20.9705	20.8192	20.3806	19.8876	19.5080	(87)
Th 2	19.9985	20.0006	20.0027	20.0124	20.0143	20.0228	20.0228	20.0244	20.0195	20.0143	20.0106	20.0067	(88)
util rest of house	0.9971	0.9932	0.9817	0.9415	0.8318	0.6314	0.4390	0.5026	0.7956	0.9657	0.9938	0.9978	(89)
MIT 2	18.6574	18.8368	19.1293	19.5149	19.8229	19.9846	20.0172	20.0142	19.9094	19.5059	19.0157	18.6337	(90)
Living area fraction	18.7817	18.9609	19.2534	19.6393	19.9509	20.1173	20.1532	20.1491	20.0377	19.6293	19.1386	18.7570	(91)
MIT	18.7817	18.9609	19.2534	19.6393	19.9509	20.1173	20.1532	20.1491	20.0377	19.6293	19.1386	18.7570	(92)
Temperature adjustment	18.7817	18.9609	19.2534	19.6393	19.9509	20.1173	20.1532	20.1491	20.0377	19.6293	19.1386	18.7570	(93)
adjusted MIT	18.7817	18.9609	19.2534	19.6393	19.9509	20.1173	20.1532	20.1491	20.0377	19.6293	19.1386	18.7570	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9959	0.9910	0.9775	0.9348	0.8287	0.6401	0.4548	0.5183	0.7969	0.9604	0.9919	0.9969	(94)
Useful gains	518.0823	611.6874	697.7507	764.7937	739.6794	566.5757	383.1509	399.0794	550.0085	566.8817	509.5653	487.1605	(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	1630.6894	1579.5902	1429.4063	1190.5904	912.8398	604.5549	389.3446	410.0661	653.0486	998.9511	1337.4382	1624.2307	(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	827.7797	650.4307	544.3518	306.5736	128.8314	0.0000	0.0000	0.0000	0.0000	321.4597	596.0685	845.9802	(98)
Space heating													
Space heating per m2	(98) / (4) = 41.3465 (99)												

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

 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	1029.9985	810.8498	831.2722	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8584	0.9169	0.8885	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	884.1419	743.4445	738.5650	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1135.7442	1084.0647	1002.5912	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	181.1537	253.4214	196.4354	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling														
Cooled fraction									FC = cooled area / (4) =			631.0105	(104)	
Intermittency factor (Table 10b)												1.0000	(105)	
	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	45.2884	63.3554	49.1089	0.0000	0.0000	0.0000	0.0000	(107)	
Space cooling													157.7526	(107)
Space cooling per m2													1.5451	(108)
Energy for space heating													41.3465	(99)
Energy for space cooling													1.5451	(108)
Total													42.8916	(109)
Dwelling Fabric Energy Efficiency (DFEE)													42.9	(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	35.5000 (1b)	x 2.4500 (2b)	= 86.9750 (1b) - (3b)
First floor	35.5000 (1c)	x 2.6000 (2c)	= 92.3000 (1c) - (3c)
Second floor	31.1000 (1d)	x 1.9500 (2d)	= 60.6450 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.9200 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (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) =		0.3542 (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	0.4516	0.4428	0.4339	0.3896	0.3808	0.3365	0.3365	0.3276	0.3542	0.3808	0.3985	0.4162 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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 Opening Type (Uw = 1.40)			14.5000	1.3258	19.2235		(27)
TER Room Window (Uw = 1.70)			0.5400	1.5918	0.8596		(27a)
ground			35.5000	0.1300	4.6150		(28a)
external	99.0500	15.2000	83.8500	0.1800	15.0930		(29a)
dormer	3.3000	1.4000	1.9000	0.1800	0.3420		(29a)
stud in roof	5.2800		5.2800	0.1800	0.9504		(29a)
cold	13.1000		13.1000	0.1300	1.7030		(30)
dormer	2.1000		2.1000	0.1300	0.2730		(30)
sloped	21.8300	0.5400	21.2900	0.1300	2.7677		(30)
cold	4.4000		4.4000	0.1300	0.5720		(30)
Total net area of external elements Aum(A, m ²)			184.5600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.4991		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7050 (36)
Total fabric heat loss						(33) + (36) =	59.2041 (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	47.6610	47.3475	47.0402	45.5967	45.3266	44.0694	44.0694	43.8366	44.5537	45.3266	45.8730	46.4442 (38)
Heat transfer coeff	106.8652	106.5516	106.2443	104.8008	104.5308	103.2735	103.2735	103.0407	103.7578	104.5308	105.0771	105.6483 (39)
Average = Sum(39)m / 12 =												104.7995 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0467	1.0436	1.0406	1.0265	1.0238	1.0115	1.0115	1.0092	1.0162	1.0238	1.0292	1.0348 (40)
HLP (average)												1.0264 (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												2.7581 (42)
Average daily hot water use (litres/day)												99.7057 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.6763	105.6880	101.6998	97.7116	93.7233	89.7351	89.7351	93.7233	97.7116	101.6998	105.6880	109.6763 (44)
Energy conte	162.6467	142.2519	146.7912	127.9761	122.7961	105.9637	98.1910	112.6756	114.0213	132.8808	145.0498	157.5147 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum (45)m = 1568.7586 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.5624	30.2285	31.1931	27.1949	26.0942	22.5173	20.8656	23.9436	24.2295	28.2372	30.8231	33.4719 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	137.9067	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.5280	21.7855	17.7172	13.4130	10.0264	8.4647	9.1464	11.8889	15.9572	20.2614	23.6480	25.2097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.6787	262.3733	255.5829	241.1269	222.8787	205.7280	194.2703	191.5757	198.3661	212.8221	231.0703	248.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	36.7907	(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)	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	(71)
Water heating gains (Table 5)	46.4549	44.9829	41.9262	37.7707	35.0728	31.2740	28.0451	32.1822	33.6521	37.9532	42.8098	44.9891	(72)
Total internal gains	395.0335	393.5138	379.5983	356.6826	332.3499	309.8388	295.8339	300.0187	312.3474	335.4087	361.9001	382.7917	(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		
Northeast					7.1500	11.2829	0.6300	0.7000	0.7700	24.6547 (75)		
Southeast					1.9000	36.7938	0.6300	0.7000	0.7700	21.3649 (77)		
Southwest					5.4500	36.7938	0.6300	0.7000	0.7700	61.2835 (79)		
Northeast					0.5400	16.3666	0.6300	0.7000	1.0000	3.5078 (82)		

Solar gains	110.8109	198.1856	296.3563	409.6382	497.7211	511.2710	485.7800	417.4168	335.1540	225.8165	134.4406	93.7232 (83)
Total gains	505.8444	591.6994	675.9546	766.3208	830.0710	821.1097	781.6139	717.4355	647.5015	561.2251	496.3407	476.5149 (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	66.3479	66.5431	66.7356	67.6548	67.8296	68.6553	68.6553	68.8105	68.3349	67.8296	67.4769	67.1121	
alpha	5.4232	5.4362	5.4490	5.5103	5.5220	5.5770	5.5770	5.5874	5.5557	5.5220	5.4985	5.4741	
util living area	0.9992	0.9980	0.9937	0.9744	0.9050	0.7433	0.5692	0.6370	0.8866	0.9873	0.9983	0.9995	(86)
MIT	19.8008	19.9448	20.1845	20.5093	20.7920	20.9523	20.9910	20.9840	20.8663	20.4982	20.0923	19.7798	(87)
Th 2	20.0446	20.0472	20.0496	20.0613	20.0635	20.0738	20.0738	20.0757	20.0698	20.0635	20.0591	20.0545	(88)
util rest of house	0.9990	0.9973	0.9913	0.9642	0.8677	0.6592	0.4557	0.5208	0.8281	0.9806	0.9975	0.9993	(89)
MIT 2	18.9410	19.0868	19.3274	19.6559	19.9186	20.0511	20.0714	20.0708	19.9913	19.6503	19.2440	18.9281	(90)
Living area fraction	19.0622	19.2078	19.4483	19.7763	20.0418	20.1782	20.2011	20.1996	20.1147	19.7699	19.3637	19.0482	(92)
Temperature adjustment	19.0622	19.2078	19.4483	19.7763	20.0418	20.1782	20.2011	20.1996	20.1147	19.7699	19.3637	19.0482	(93)
adjusted MIT	19.0622	19.2078	19.4483	19.7763	20.0418	20.1782	20.2011	20.1996	20.1147	19.7699	19.3637	19.0482	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9986	0.9964	0.9893	0.9602	0.8667	0.6695	0.4718	0.5372	0.8314	0.9778	0.9968	0.9990	(94)
Ext temp.	505.1241	589.5845	668.7234	735.8586	719.4431	549.6984	368.7755	385.3707	538.3452	548.7400	494.7296	476.0269	(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	1577.5702	1524.5159	1375.6858	1139.8429	871.9723	576.0802	371.8960	391.5158	624.0757	958.5372	1288.6311	1568.6892	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	797.8999	628.2740	525.9800	290.8687	113.4817	0.0000	0.0000	0.0000	0.0000	304.8891	571.6091	812.9407	(98)
												4045.9432	(98)
												39.6273	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	970.7711	764.2241	783.1093	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8830	0.9395	0.9144	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	857.1460	717.9870	716.0385	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1060.9671	1012.9242	941.1068	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	146.7512	219.4332	167.4509	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			533.6353 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	36.6878	54.8583	41.8627	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												133.4088 (107)
Energy for space heating												1.3066 (108)
Energy for space cooling												39.6273 (99)
Total												1.3066 (108)
Target Fabric Energy Efficiency (TFEE)												40.9339 (109)
												47.1 (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	35.5000 (1b)	x 2.4500 (2b)	= 86.9750 (1b) - (3b)
First floor	35.5000 (1c)	x 2.6000 (2c)	= 92.3000 (1c) - (3c)
Second floor	31.1000 (1d)	x 1.9500 (2d)	= 60.6450 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.9200 (5)

2. Ventilation rate

	main heating				secondary heating				other		total	m3 per hour			
Number of chimneys					0	+		0	+	0	=	0 * 40 =	0.0000	(6a)	
Number of open flues					0	+		0	+	0	=	0 * 20 =	0.0000	(6b)	
Number of intermittent fans												0 * 10 =	0.0000	(7a)	
Number of passive vents												0 * 10 =	0.0000	(7b)	
Number of flueless gas fires												0 * 40 =	0.0000	(7c)	
												Air changes per hour			
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										0.0000	/ (5) =	0.0000	(8)	
Pressure test													Yes		
Measured/design AP50													4.3200		
Infiltration rate													0.2160	(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) =		0.1836	(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)		
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															
	0.2157	0.2020	0.2020	0.1836	0.1882	0.1790	0.1790	0.1744	0.1744	0.1882	0.1836	0.1882	(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)
front (Uw = 1.40)			14.5000	1.3258	19.2235		(27)
rear (Uw = 1.70)			0.5400	1.5918	0.8596		(27a)
ground			35.5000	0.1200	4.2600	75.0000	2662.5000 (28a)
external	99.0500	15.2000	83.8500	0.2700	22.6395	150.0000	12577.5004 (29a)
dormer	3.3000	1.4000	1.9000	0.3300	0.6270	9.0000	17.1000 (29a)
stud in roof	5.2800		5.2800	0.1300	0.6864	9.0000	47.5200 (29a)
cold	13.1000		13.1000	0.1100	1.4410	9.0000	117.9000 (30)
dormer	2.1000		2.1000	0.2000	0.4200	9.0000	18.9000 (30)
sloped	21.8300	0.5400	21.2900	0.1800	3.8322	9.0000	191.6100 (30)
cold	4.4000		4.4000	0.1300	0.5720	9.0000	39.6000 (30)
Total net area of external elements Aum(A, m ²)			184.5600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.6611		(33)
party			54.1000	0.0000	0.0000	45.0000	2434.4999 (32)
stud			141.2000			9.0000	1270.8000 (32c)
internal			66.6000			18.0000	1198.8000 (32d)
internal			66.6000			9.0000	599.4000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		21176.1303 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							207.4058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5454 (36)
Total fabric heat loss						(33) + (36) =	66.2065 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan 39.5868	Feb 39.5868	Mar 39.5868	Apr 39.5868	May 39.5868	Jun 39.5868	Jul 39.5868	Aug 39.5868	Sep 39.5868	Oct 39.5868	Nov 39.5868	Dec 39.5868 (38)
Heat transfer coeff	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933 (39)
Average = Sum(39)m / 12 =												105.7933 (39)
HLP	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362 (40)
HLP (average)												1.0362 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Assumed occupancy												2.7581 (42)
Average daily hot water use (litres/day)												99.7057 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.6763	105.6880	101.6998	97.7116	93.7233	89.7351	89.7351	93.7233	97.7116	101.6998	105.6880	109.6763 (44)
Energy conte	162.6467	142.2519	146.7912	127.9761	122.7961	105.9637	98.1910	112.6756	114.0213	132.8808	145.0498	157.5147 (45)
Energy content (annual)												Total = Sum(45)m = 1568.7586 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3970	21.3378	22.0187	19.1964	18.4194	15.8946	14.7286	16.9013	17.1032	19.9321	21.7575	23.6272 (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	14.1469	12.7667	14.1089	13.6129	14.0328	13.5410	13.9680	14.0100	13.5802	14.0755	13.6609	14.1346 (61)
Total heat required for water heating calculated for each month	176.7936	155.0185	160.9000	141.5890	136.8289	119.5047	112.1590	126.6856	127.6014	146.9563	158.7107	171.6493 (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	176.7936	155.0185	160.9000	141.5890	136.8289	119.5047	112.1590	126.6856	127.6014	146.9563	158.7107	171.6493 (64)
RHI water heating demand												Total per year (kWh/year) = Sum(64)m = 1734.3970 (64)
Heat gains from water heating, kWh/month	57.6168	50.4904	52.3353	45.9553	44.3379	38.6182	36.1405	40.9671	41.3071	47.7017	51.6443	55.9073 (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	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.3199	54.4638	44.2930	33.5326	25.0660	21.1618	22.8661	29.7222	39.8930	50.6534	59.1200	63.0242 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	387.5801	391.6020	381.4670	359.8908	332.6548	307.0568	289.9557	285.9338	296.0688	317.6450	344.8810	370.4791 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069 (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)	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254 (71)
Water heating gains (Table 5)	77.4419	75.1345	70.3431	63.8268	59.5940	53.6364	48.5759	55.0633	57.3710	64.1152	71.7282	75.1442 (72)
Total internal gains	638.8116	633.6700	608.5727	569.7199	529.7844	494.3245	473.8673	483.1890	505.8025	544.8832	588.1988	621.1171 (73)

6. Solar gains

[Jan]												Gains
			Area m2			Solar flux Table 6a W/m2	g		FF		Access factor Table 6d	W
							Specific data or Table 6b		Specific data or Table 6c			
Northeast			7.1500			14.6130	0.4500		0.0000		0.7700	36.2034 (75)
Southeast			1.9000			45.0642	0.4500		0.0000		0.7700	29.6680 (77)
Southwest			5.4500			45.0642	0.4500		0.0000		0.7700	85.1003 (79)
Northeast			0.5400			21.2590	0.6300		0.7000		1.0000	4.5564 (82)
Solar gains	155.5281	237.5578	363.6434	507.1416	580.9805	660.4861	602.9362	540.0108	431.4775	292.6622	188.2481	124.4224 (83)
Total gains	794.3397	871.2278	972.2161	1076.8615	1110.7649	1154.8106	1076.8035	1023.1998	937.2800	837.5454	776.4468	745.5395 (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	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014
alpha	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068
util living area	0.9823	0.9723	0.9398	0.8518	0.6916	0.4602	0.3231	0.3296	0.6031	0.8693	0.9636	0.9858 (86)
MIT	20.0754	20.1942	20.4511	20.7430	20.9264	20.9912	20.9987	20.9986	20.9704	20.7675	20.3861	20.0376 (87)
Th 2	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533 (88)
util rest of house	0.9774	0.9649	0.9239	0.8154	0.6267	0.3780	0.2310	0.2328	0.5129	0.8267	0.9520	0.9818 (89)
MIT 2	19.2336	19.3496	19.5967	19.8628	20.0103	20.0501	20.0531	20.0531	20.0407	19.8910	19.5387	19.1967 (90)
Living area fraction	19.3523	19.4687	19.7172	19.9869	20.1395	20.1829	20.1865	20.1864	20.1718	20.0146	19.6582	19.3153 (92)
MIT	19.3523	19.4687	19.7172	19.9869	20.1395	20.1829	20.1865	20.1864	20.1718	20.0146	19.6582	19.3153 (92)
Temperature adjustment	19.2023	19.3187	19.5672	19.8369	19.9895	20.0329	20.0365	20.0364	20.0218	19.8646	19.5082	-0.1500
adjusted MIT	19.2023	19.3187	19.5672	19.8369	19.9895	20.0329	20.0365	20.0364	20.0218	19.8646	19.5082	19.1653 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9717	0.9576	0.9140	0.8060	0.6220	0.3762	0.2294	0.2311	0.5097	0.8167	0.9434	0.9768 (94)
Ext temp.	771.8741	834.2452	888.5815	867.9241	690.9446	434.4084	246.9946	236.4165	477.7479	683.9973	732.5278	728.2399 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1439.0331	1409.0325	1266.0467	1030.1033	728.8645	437.2298	247.1815	236.6013	488.9577	821.4432	1154.0148	1424.5374	(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	496.3663	386.2570	280.8341	116.7690	28.2124	0.0000	0.0000	0.0000	0.0000	102.2597	303.4706	518.0453	(98)
RHI space heating demand												2232	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.5000 (1b)	x 2.4500 (2b)	= 86.9750 (1b) - (3b)
First floor	35.5000 (1c)	x 2.6000 (2c)	= 92.3000 (1c) - (3c)
Second floor	31.1000 (1d)	x 1.9500 (2d)	= 60.6450 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.9200 (5)

2. Ventilation rate

						main heating	secondary heating	other		total	m3 per hour			
Number of chimneys						0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues						0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans												0 * 10 =	0.0000 (7a)	
Number of passive vents												0 * 10 =	0.0000 (7b)	
Number of flueless gas fires												0 * 40 =	0.0000 (7c)	
												Air changes per hour		
Infiltration due to chimneys, flues and fans						= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =		0.0000 (8)
Pressure test												Yes		
Measured/design AP50														4.3200
Infiltration rate														0.2160 (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) =		0.1836 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)	
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)	
Adj infilt rate														
	0.2341	0.2295	0.2249	0.2020	0.1974	0.1744	0.1744	0.1698	0.1836	0.1974	0.2066	0.2157	(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)
front (Uw = 1.40)			14.5000	1.3258	19.2235		(27)
rear (Uw = 1.70)			0.5400	1.5918	0.8596		(27a)
ground			35.5000	0.1200	4.2600	75.0000	2662.5000 (28a)
external	99.0500	15.2000	83.8500	0.2700	22.6395	150.0000	12577.5004 (29a)
dormer	3.3000	1.4000	1.9000	0.3300	0.6270	9.0000	17.1000 (29a)
stud in roof	5.2800		5.2800	0.1300	0.6864	9.0000	47.5200 (29a)
cold	13.1000		13.1000	0.1100	1.4410	9.0000	117.9000 (30)
dormer	2.1000		2.1000	0.2000	0.4200	9.0000	18.9000 (30)
sloped	21.8300	0.5400	21.2900	0.1800	3.8322	9.0000	191.6100 (30)
cold	4.4000		4.4000	0.1300	0.5720	9.0000	39.6000 (30)
Total net area of external elements Aum(A, m ²)			184.5600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.6611		(33)
party			54.1000	0.0000	0.0000	45.0000	2434.4999 (32)
stud			141.2000			9.0000	1270.8000 (32c)
internal			66.6000			18.0000	1198.8000 (32d)
internal			66.6000			9.0000	599.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21176.1303 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							207.4058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5454 (36)
Total fabric heat loss						(33) + (36) =	66.2065 (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	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868 (38)
Heat transfer coeff	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933 (39)
Average = Sum(39)m / 12 =												105.7933 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Assumed occupancy													2.7581 (42)
Average daily hot water use (litres/day)													99.7057 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.6763	105.6880	101.6998	97.7116	93.7233	89.7351	89.7351	93.7233	97.7116	101.6998	105.6880	109.6763 (44)	
Energy content (annual)	162.6467	142.2519	146.7912	127.9761	122.7961	105.9637	98.1910	112.6756	114.0213	132.8808	145.0498	157.5147 (45)	
Distribution loss (46)m = 0.15 x (45)m	24.3970	21.3378	22.0187	19.1964	18.4194	15.8946	14.7286	16.9013	17.1032	19.9321	21.7575	23.6272 (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	14.1469	12.7667	14.1089	13.6129	14.0328	13.5410	13.9680	14.0100	13.5802	14.0755	13.6609	14.1346 (61)	
Total heat required for water heating calculated for each month	176.7936	155.0185	160.9000	141.5890	136.8289	119.5047	112.1590	126.6856	127.6014	146.9563	158.7107	171.6493 (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	176.7936	155.0185	160.9000	141.5890	136.8289	119.5047	112.1590	126.6856	127.6014	146.9563	158.7107	171.6493 (64)	
Heat gains from water heating, kWh/month	57.6168	50.4904	52.3353	45.9553	44.3379	38.6182	36.1405	40.9671	41.3071	47.7017	51.6443	55.9073 (65)	
Total per year (kWh/year) = Sum(64)m =													1734.3970 (64)
5. Internal gains (see Table 5 and 5a)													
Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.3199	54.4638	44.2930	33.5326	25.0660	21.1618	22.8661	29.7222	39.8930	50.6534	59.1200	63.0242 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	387.5801	391.6020	381.4670	359.8908	332.6548	307.0568	289.9557	285.9338	296.0688	317.6450	344.8810	370.4791 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069 (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)	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254 (71)	
Water heating gains (Table 5)	77.4419	75.1345	70.3431	63.8268	59.5940	53.6364	48.5759	55.0633	57.3710	64.1152	71.7282	75.1442 (72)	
Total internal gains	638.8116	633.6700	608.5727	569.7199	529.7844	494.3245	473.8673	483.1890	505.8025	544.8832	588.1988	621.1171 (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								
Northeast	7.1500	11.2829	0.4500	0.0000	0.7700	27.9532 (75)							
Southeast	1.9000	36.7938	0.4500	0.0000	0.7700	24.2232 (77)							
Southwest	5.4500	36.7938	0.4500	0.0000	0.7700	69.4824 (79)							
Northeast	0.5400	16.3666	0.6300	0.7000	1.0000	3.5078 (82)							
Solar gains	125.1666	223.7344	334.2233	461.4352	560.1904	575.2469	546.6447	470.0200	377.7979	254.8379	151.8350	105.8796 (83)	
Total gains	763.9782	857.4044	942.7960	1031.1550	1089.9748	1069.5715	1020.5120	953.2090	883.6004	799.7211	740.0338	726.9966 (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	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	
alpha	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	
util living area	0.9889	0.9800	0.9584	0.9009	0.7801	0.6039	0.4499	0.4997	0.7381	0.9274	0.9800	0.9912 (86)	
MIT	19.8987	20.0600	20.3134	20.6175	20.8545	20.9660	20.9931	20.9888	20.9152	20.6094	20.1883	19.8491 (87)	
Th 2	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533 (88)	
util rest of house	0.9861	0.9748	0.9476	0.8754	0.7289	0.5254	0.3562	0.4020	0.6641	0.9030	0.9739	0.9888 (89)	
MIT 2	19.0586	19.2176	19.4647	19.7513	19.9561	20.0370	20.0513	20.0497	20.0065	19.7506	19.3458	19.0096 (90)	
Living area fraction	fLA = Living area / (4) =												
MIT	19.1771	19.3364	19.5844	19.8735	20.0828	20.1680	20.1841	20.1822	20.1347	19.8717	19.4646	19.1280 (92)	
Temperature adjustment													
adjusted MIT	19.0271	19.1864	19.4344	19.7235	19.9328	20.0180	20.0341	20.0322	19.9847	19.7217	19.3146	18.9780 (93)	
8. Space heating requirement													
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9819	0.9688	0.9388	0.8650	0.7217	0.5223	0.3542	0.3998	0.6582	0.8924	0.9677	0.9853 (94)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)	
Heat loss rate W	1558.0309	1511.4105	1368.3731	1145.0527	870.9733	573.1896	363.3041	384.2574	622.5573	965.0139	1292.2223	1563.4134 (97)	

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Month fraction	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	601.0723	457.4975	359.5292	182.2215	62.7476	0.0000	0.0000	0.0000	0.0000	186.9704	414.8071	630.2702 (98)
Space heating												2895.1158 (98)
Space heating per m2										(98) / (4) =		28.3557 (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												3199.0230 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	601.0723	457.4975	359.5292	182.2215	62.7476	0.0000	0.0000	0.0000	0.0000	186.9704	414.8071	630.2702 (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)	664.1683	505.5221	397.2698	201.3497	69.3344	0.0000	0.0000	0.0000	0.0000	206.5971	458.3504	696.4312 (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	176.7936	155.0185	160.9000	141.5890	136.8289	119.5047	112.1590	126.6856	127.6014	146.9563	158.7107	171.6493 (64)
Efficiency of water heater (217)m	89.7523	89.6682	89.4859	89.0724	88.2814	87.3000	87.3000	87.3000	87.3000	89.0633	89.5912	87.3000 (216)
Fuel for water heating, kWh/month	196.9796	172.8802	179.8049	158.9595	154.9917	136.8897	128.4754	145.1152	146.1643	165.0021	177.1498	191.1558 (219)
Water heating fuel used												1953.5682 (219)
Annual totals kWh/year												
Space heating fuel - main system												3199.0230 (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)												61.9318 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												136.9318 (231)
Electricity for lighting (calculated in Appendix L)												433.1717 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.90 * 677 * 1.00) =										-487.0835		-487.0835 (233)
Total delivered energy for all uses												5235.6113 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3199.0230	3.4800	111.3260 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1953.5682	3.4800	67.9842 (247)
Mechanical ventilation fans	61.9318	13.1900	8.1688 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	433.1717	13.1900	57.1354 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-487.0835	13.1900	-64.2463 (252)
Total energy cost			310.2605 (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] =	0.8859 (257)
SAP value		87.6423
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	3199.0230	0.2160	690.9890 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1953.5682	0.2160	421.9707 (264)
Space and water heating			1112.9597 (265)
Pumps and fans	136.9318	0.5190	71.0676 (267)
Energy for lighting	433.1717	0.5190	224.8161 (268)

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Energy saving/generation technologies			
PV Unit	-487.0835	0.5190	-252.7963 (269)
Total kg/year			1156.0471 (272)
CO2 emissions per m2			11.3200 (273)
EI value			89.4690
EI rating			89 (274)
EI band			B

----- Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8866 = 3.925$, stars = 4
Water heating environmental impact	$0.216 / 0.8866 = 0.2436$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.5000 (1b)	x 2.4500 (2b)	= 86.9750 (1b) - (3b)
First floor	35.5000 (1c)	x 2.6000 (2c)	= 92.3000 (1c) - (3c)
Second floor	31.1000 (1d)	x 1.9500 (2d)	= 60.6450 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.9200 (5)

2. Ventilation rate

						main heating	secondary heating	other		total	m3 per hour		
Number of chimneys						0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues						0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans												0 * 10 =	0.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans						= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)
Pressure test												Yes	
Measured/design AP50													4.3200
Infiltration rate													0.2160 (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) =							0.1836 (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)
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													
	0.2157	0.2020	0.2020	0.1836	0.1882	0.1790	0.1790	0.1744	0.1744	0.1882	0.1836	0.1882	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
entrance			2.1000	1.0000	2.1000			(26)
front (Uw = 1.40)			14.5000	1.3258	19.2235			(27)
rear (Uw = 1.70)			0.5400	1.5918	0.8596			(27a)
ground			35.5000	0.1200	4.2600			(28a)
external	99.0500	15.2000	83.8500	0.2700	22.6395	75.0000	2662.5000	(29a)
dormer	3.3000	1.4000	1.9000	0.3300	0.6270	9.0000	17.1000	(29a)
stud in roof	5.2800		5.2800	0.1300	0.6864	9.0000	47.5200	(29a)
cold	13.1000		13.1000	0.1100	1.4410	9.0000	117.9000	(30)
dormer	2.1000		2.1000	0.2000	0.4200	9.0000	18.9000	(30)
sloped	21.8300	0.5400	21.2900	0.1800	3.8322	9.0000	191.6100	(30)
cold	4.4000		4.4000	0.1300	0.5720	9.0000	39.6000	(30)
Total net area of external elements Aum(A, m2)			184.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.6611			(33)
party			54.1000	0.0000	0.0000	45.0000	2434.4999	(32)
stud			141.2000			9.0000	1270.8000	(32c)
internal			66.6000			18.0000	1198.8000	(32d)
internal			66.6000			9.0000	599.4000	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		21176.1303	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							207.4058	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5454	(36)
Total fabric heat loss						(33) + (36) =	66.2065	(37)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Assumed occupancy												2.7581 (42)
Average daily hot water use (litres/day)												99.7057 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.6763	105.6880	101.6998	97.7116	93.7233	89.7351	89.7351	93.7233	97.7116	101.6998	105.6880	109.6763 (44)
Energy content (annual)	162.6467	142.2519	146.7912	127.9761	122.7961	105.9637	98.1910	112.6756	114.0213	132.8808	145.0498	157.5147 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3970	21.3378	22.0187	19.1964	18.4194	15.8946	14.7286	16.9013	17.1032	19.9321	21.7575	23.6272 (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	14.1469	12.7667	14.1089	13.6129	14.0328	13.5410	13.9680	14.0100	13.5802	14.0755	13.6609	14.1346 (61)
Total heat required for water heating calculated for each month	176.7936	155.0185	160.9000	141.5890	136.8289	119.5047	112.1590	126.6856	127.6014	146.9563	158.7107	171.6493 (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	176.7936	155.0185	160.9000	141.5890	136.8289	119.5047	112.1590	126.6856	127.6014	146.9563	158.7107	171.6493 (64)
Heat gains from water heating, kWh/month	57.6168	50.4904	52.3353	45.9553	44.3379	38.6182	36.1405	40.9671	41.3071	47.7017	51.6443	55.9073 (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	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.3199	54.4638	44.2930	33.5326	25.0660	21.1618	22.8661	29.7222	39.8930	50.6534	59.1200	63.0242 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	387.5801	391.6020	381.4670	359.8908	332.6548	307.0568	289.9557	285.9338	296.0688	317.6450	344.8810	370.4791 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069 (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)	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254 (71)
Water heating gains (Table 5)	77.4419	75.1345	70.3431	63.8268	59.5940	53.6364	48.5759	55.0633	57.3710	64.1152	71.7282	75.1442 (72)
Total internal gains	638.8116	633.6700	608.5727	569.7199	529.7844	494.3245	473.8673	483.1890	505.8025	544.8832	588.1988	621.1171 (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		
Northeast	7.1500			14.6130		0.4500		0.0000		0.7700		36.2034 (75)
Southeast	1.9000			45.0642		0.4500		0.0000		0.7700		29.6680 (77)
Southwest	5.4500			45.0642		0.4500		0.0000		0.7700		85.1003 (79)
Northeast	0.5400			21.2590		0.6300		0.7000		1.0000		4.5564 (82)
Solar gains	155.5281	237.5578	363.6434	507.1416	580.9805	660.4861	602.9362	540.0108	431.4775	292.6622	188.2481	124.4224 (83)
Total gains	794.3397	871.2278	972.2161	1076.8615	1110.7649	1154.8106	1076.8035	1023.1998	937.2800	837.5454	776.4468	745.5395 (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	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014
alpha	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068
util living area	0.9823	0.9723	0.9398	0.8518	0.6916	0.4602	0.3231	0.3296	0.6031	0.8693	0.9636	0.9858 (86)
MIT	20.0754	20.1942	20.4511	20.7430	20.9264	20.9912	20.9987	20.9986	20.9704	20.7675	20.3861	20.0376 (87)
Th 2	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533 (88)
util rest of house	0.9774	0.9649	0.9239	0.8154	0.6267	0.3780	0.2310	0.2328	0.5129	0.8267	0.9520	0.9818 (89)
MIT 2	19.2336	19.3496	19.5967	19.8628	20.0103	20.0501	20.0531	20.0531	20.0407	19.8910	19.5387	19.1967 (90)
Living area fraction	19.3523	19.4687	19.7172	19.9869	20.1395	20.1829	20.1865	20.1864	20.1718	20.0146	19.6582	19.3153 (91)
MIT	19.3523	19.4687	19.7172	19.9869	20.1395	20.1829	20.1865	20.1864	20.1718	20.0146	19.6582	19.3153 (92)
Temperature adjustment	19.2023	19.3187	19.5672	19.8369	19.9895	20.0329	20.0365	20.0364	20.0218	19.8646	19.5082	-0.1500
adjusted MIT	19.2023	19.3187	19.5672	19.8369	19.9895	20.0329	20.0365	20.0364	20.0218	19.8646	19.5082	19.1653 (93)

8. Space heating requirement												

Utilisation	0.9717	0.9576	0.9140	0.8060	0.6220	0.3762	0.2294	0.2311	0.5097	0.8167	0.9434	0.9768 (94)
Useful gains	771.8741	834.2452	888.5815	867.9241	690.9446	434.4084	246.9946	236.4165	477.7479	683.9973	732.5278	728.2399 (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	1439.0331	1409.0325	1266.0467	1030.1033	728.8645	437.2298	247.1815	236.6013	488.9577	821.4432	1154.0148	1424.5374 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	496.3663	386.2570	280.8341	116.7690	28.2124	0.0000	0.0000	0.0000	0.0000	102.2597	303.4706	518.0453 (98)
Space heating												2232.2145 (98)
Space heating per m2										(98) / (4) =		21.8630 (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												2466.5354 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	496.3663	386.2570	280.8341	116.7690	28.2124	0.0000	0.0000	0.0000	0.0000	102.2597	303.4706	518.0453 (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)	548.4710	426.8033	310.3139	129.0265	31.1739	0.0000	0.0000	0.0000	0.0000	112.9942	335.3267	572.4258 (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	176.7936	155.0185	160.9000	141.5890	136.8289	119.5047	112.1590	126.6856	127.6014	146.9563	158.7107	171.6493 (64)
Efficiency of water heater	89.6371	89.5598	89.3076	88.7178	87.8309	87.3000	87.3000	87.3000	87.3000	88.5853	89.3750	87.3000 (216)
(217)m	89.6371	89.5598	89.3076	88.7178	87.8309	87.3000	87.3000	87.3000	87.3000	88.5853	89.3750	89.6819 (217)
Fuel for water heating, kWh/month	197.2327	173.0894	180.1639	159.5948	155.7868	136.8897	128.4754	145.1152	146.1643	165.8924	177.5784	191.3980 (219)
Water heating fuel used												1957.3808 (219)
Annual totals kWh/year												
Space heating fuel - main system												2466.5354 (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)												61.9318 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												136.9318 (231)
Electricity for lighting (calculated in Appendix L)												433.1717 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.90 * 780 * 1.00) =										-561.9528		-561.9528 (233)
Total delivered energy for all uses												4432.0669 (238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2466.5354	9.7400	240.2405 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1957.3808	9.7400	190.6489 (247)
Mechanical ventilation fans	61.9318	36.8500	22.8219 (249)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	433.1717	36.8500	159.6238 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-561.9528	36.8500	-207.0796 (252)
Total energy cost			537.8930 (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	2466.5354	0.2160	532.7716 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1957.3808	0.2160	422.7943 (264)
Space and water heating			955.5659 (265)
Pumps and fans	136.9318	0.5190	71.0676 (267)
Energy for lighting	433.1717	0.5190	224.8161 (268)
Energy saving/generation technologies			
PV Unit	-561.9528	0.5190	-291.6535 (269)
Total kg/year			959.7961 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space heating - main system 1	2466.5354	1.2200	3009.1732 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1957.3808	1.2200	2388.0046 (264)
Space and water heating			5397.1778 (265)
Pumps and fans	136.9318	3.0700	420.3806 (267)
Energy for lighting	433.1717	3.0700	1329.8372 (268)
Energy saving/generation technologies			
PV Unit	-561.9528	3.0700	-1725.1951 (269)
Primary energy kWh/year			5422.2005 (272)
Primary energy kWh/m2/year			53.1068 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 81	-194 kg (20.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£81 1.90 kg/m²	B 89	B 91
Total Savings	£81 1.90 kg/m²		

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

Fuel prices for cost data on this page from database revision number 516 TEST (28 Apr 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	£210	£229	-£18
Mains gas	£535	£436	£99
Space heating	£395	£395	£0
Water heating	£191	£110	£81
Lighting	£160	£160	£0
Generated (PV)	-£207	-£207	£0
Total cost of fuels	£538	£458	£81
Total cost of uses	£539	£458	£81
Delivered energy	43 kWh/m²	34 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	42 kWh/m²	11 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	35.5000 (1b)	x 2.4500 (2b)	= 86.9750 (1b) - (3b)
First floor	35.5000 (1c)	x 2.6000 (2c)	= 92.3000 (1c) - (3c)
Second floor	31.1000 (1d)	x 1.9500 (2d)	= 60.6450 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.9200 (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) =								Air changes per hour				
Pressure test							0.0000 / (5) =	0.0000 (8)				
Measured/design AP50							Yes					
Infiltration rate								4.3200				
Number of sides sheltered								0.2160 (18)				
								2 (19)				
Shelter factor						(20) = 1 - [0.075 x (19)] =		0.8500 (20)				
Infiltration rate adjusted to include shelter factor						(21) = (18) x (20) =		0.1836 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2341	0.2295	0.2249	0.2020	0.1974	0.1744	0.1744	0.1698	0.1836	0.1974	0.2066	0.2157 (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)
front (Uw = 1.40)			14.5000	1.3258	19.2235		(27)
rear (Uw = 1.70)			0.5400	1.5918	0.8596		(27a)
ground			35.5000	0.1200	4.2600	75.0000	2662.5000 (28a)
external	99.0500	15.2000	83.8500	0.2700	22.6395	150.0000	12577.5004 (29a)
dormer	3.3000	1.4000	1.9000	0.3300	0.6270	9.0000	17.1000 (29a)
stud in roof	5.2800		5.2800	0.1300	0.6864	9.0000	47.5200 (29a)
cold	13.1000		13.1000	0.1100	1.4410	9.0000	117.9000 (30)
dormer	2.1000		2.1000	0.2000	0.4200	9.0000	18.9000 (30)
sloped	21.8300	0.5400	21.2900	0.1800	3.8322	9.0000	191.6100 (30)
cold	4.4000		4.4000	0.1300	0.5720	9.0000	39.6000 (30)
Total net area of external elements Aum(A, m ²)			184.5600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.6611		(33)
party			54.1000	0.0000	0.0000	45.0000	2434.4999 (32)
stud			141.2000			9.0000	1270.8000 (32c)
internal			66.6000			18.0000	1198.8000 (32d)
internal			66.6000			9.0000	599.4000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		21176.1303 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							207.4058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5454 (36)
Total fabric heat loss					(33) + (36) =		66.2065 (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	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868	39.5868 (38)
Heat transfer coeff	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933 (39)
Average = Sum(39)m / 12 =												105.7933 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Assumed occupancy												2.7581 (42)
Average daily hot water use (litres/day)												99.7057 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.6763	105.6880	101.6998	97.7116	93.7233	89.7351	89.7351	93.7233	97.7116	101.6998	105.6880	109.6763 (44)
Energy content (annual)	162.6467	142.2519	146.7912	127.9761	122.7961	105.9637	98.1910	112.6756	114.0213	132.8808	145.0498	157.5147 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1568.7586 (45)
	24.3970	21.3378	22.0187	19.1964	18.4194	15.8946	14.7286	16.9013	17.1032	19.9321	21.7575	23.6272 (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	14.1469	12.7667	14.1089	13.6129	14.0328	13.5410	13.9680	14.0100	13.5802	14.0755	13.6609	14.1346 (61)
Total heat required for water heating calculated for each month	176.7936	155.0185	160.9000	141.5890	136.8289	119.5047	112.1590	126.6856	127.6014	146.9563	158.7107	171.6493 (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												1.1561 (H8)
Utilisation factor												0.5789 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.7057 (H14)
Volume ratio Veff/V												0.7522 (H15)
Solar storage volume factor												0.9431 (H16)
Solar input												-870.6639 (H17)
Solar input	-25.2475	-42.1309	-71.7537	-96.1640	-118.8026	-116.8019	-115.2583	-100.7017	-78.8697	-53.8587	-29.9472	-21.1279 (63)
												Solar input (sum of months) = Sum(63)m = -870.6639 (63)
Output from w/h	151.5461	112.8877	89.1464	45.4250	18.0263	2.7029	0.0000	25.9838	48.7318	93.0976	128.7635	150.5214 (64)
												Total per year (kWh/year) = Sum(64)m = 866.8323 (64)
Heat gains from water heating, kWh/month	57.6168	50.4904	52.3353	45.9553	44.3379	38.6182	36.1405	40.9671	41.3071	47.7017	51.6443	55.9073 (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	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.3199	54.4638	44.2930	33.5326	25.0660	21.1618	22.8661	29.7222	39.8930	50.6534	59.1200	63.0242 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	387.5801	391.6020	381.4670	359.8908	332.6548	307.0568	289.9557	285.9338	296.0688	317.6450	344.8810	370.4791 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069 (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)	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254 (71)
Water heating gains (Table 5)	77.4419	75.1345	70.3431	63.8268	59.5940	53.6364	48.5759	55.0633	57.3710	64.1152	71.7282	75.1442 (72)
Total internal gains	638.8116	633.6700	608.5727	569.7199	529.7844	494.3245	473.8673	483.1890	505.8025	544.8832	588.1988	621.1171 (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		
Northeast					7.1500	11.2829	0.4500	0.0000	0.7700		27.9532 (75)		
Southeast					1.9000	36.7938	0.4500	0.0000	0.7700		24.2232 (77)		
Southwest					5.4500	36.7938	0.4500	0.0000	0.7700		69.4824 (79)		
Northeast					0.5400	16.3666	0.6300	0.7000	1.0000		3.5078 (82)		

Solar gains	125.1666	223.7344	334.2233	461.4352	560.1904	575.2469	546.6447	470.0200	377.7979	254.8379	151.8350	105.8796 (83)	
Total gains	763.9782	857.4044	942.7960	1031.1550	1089.9748	1069.5715	1020.5120	953.2090	883.6004	799.7211	740.0338	726.9966 (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	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014
alpha	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068
util living area	0.9889	0.9800	0.9584	0.9009	0.7801	0.6039	0.4499	0.4997	0.7381	0.9274	0.9800	0.9912 (86)
MIT	19.8987	20.0600	20.3134	20.6175	20.8545	20.9660	20.9931	20.9888	20.9152	20.6094	20.1883	19.8491 (87)
Th 2	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	0.9861	0.9748	0.9476	0.8754	0.7289	0.5254	0.3562	0.4020	0.6641	0.9030	0.9739	0.9888 (89)
Living area fraction	19.0586	19.2176	19.4647	19.7513	19.9561	20.0370	20.0513	20.0497	20.0065	19.7506	19.3458	19.0096 (90)
MIT	19.1771	19.3364	19.5844	19.8735	20.0828	20.1680	20.1841	20.1822	fLA = Living area / (4) =			0.1410 (91)
Temperature adjustment									20.1347	19.8717	19.4646	19.1280 (92)
adjusted MIT	19.0271	19.1864	19.4344	19.7235	19.9328	20.0180	20.0341	20.0322	19.9847	19.7217	19.3146	-0.1500
												18.9780 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9819	0.9688	0.9388	0.8650	0.7217	0.5223	0.3542	0.3998	0.6582	0.8924	0.9677	0.9853 (94)
Useful gains	750.1381	830.6106	885.1350	891.9674	786.6350	558.6578	361.4880	381.0525	581.6206	713.7095	716.1013	716.2760 (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												
Month fracti	1558.0309	1511.4105	1368.3731	1145.0527	870.9733	573.1896	363.3041	384.2574	622.5573	965.0139	1292.2223	1563.4134 (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	601.0723	457.4975	359.5292	182.2215	62.7476	0.0000	0.0000	0.0000	0.0000	186.9704	414.8071	630.2702 (98)
Space heating per m2												2895.1158 (98)
										(98) / (4) =		28.3557 (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	3199.0230 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	601.0723	457.4975	359.5292	182.2215	62.7476	0.0000	0.0000	0.0000	0.0000	186.9704	414.8071	630.2702 (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)	664.1683	505.5221	397.2698	201.3497	69.3344	0.0000	0.0000	0.0000	0.0000	206.5971	458.3504	696.4312 (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	151.5461	112.8877	89.1464	45.4250	18.0263	2.7029	0.0000	25.9838	48.7318	93.0976	128.7635	150.5214 (64)
Efficiency of water heater (217)m	89.8369	89.8482	89.8457	89.8429	89.7657	87.3000	87.3000	87.3000	87.3000	89.4106	89.7209	87.3000 (216)
Fuel for water heating, kWh/month	168.6902	125.6427	99.2217	50.5605	20.0815	3.0961	0.0000	29.7638	55.8211	104.1237	143.5155	167.4973 (219)
Water heating fuel used												968.0140 (219)
Annual totals kWh/year												
Space heating fuel - main system												3199.0230 (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)	61.9318 (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	186.9318 (231)
Electricity for lighting (calculated in Appendix L)	433.1717 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.90 * 677 * 1.00) =	-487.0835
Total delivered energy for all uses	4300.0570 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3199.0230	3.4800	111.3260 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	968.0140	3.4800	33.6869 (247)
Mechanical ventilation fans	61.9318	13.1900	8.1688 (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	433.1717	13.1900	57.1354 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-487.0835	13.1900	-64.2463 (252)
Total energy cost			282.5582 (255)

11a. SAP rating - Individual heating systems

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8068 (257)
SAP value		88.7457
SAP rating (Section 12)		89 (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	3199.0230	0.2160	690.9890 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	968.0140	0.2160	209.0910 (264)
Space and water heating			900.0800 (265)
Pumps and fans	186.9318	0.5190	97.0176 (267)
Energy for lighting	433.1717	0.5190	224.8161 (268)
Energy saving/generation technologies			
PV Unit	-487.0835	0.5190	-252.7963 (269)
Total kg/year			969.1174 (272)
CO2 emissions per m2			9.4900 (273)
EI value			91.1719
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.5000 (1b)	x 2.4500 (2b)	= 86.9750 (1b) - (3b)
First floor	35.5000 (1c)	x 2.6000 (2c)	= 92.3000 (1c) - (3c)
Second floor	31.1000 (1d)	x 1.9500 (2d)	= 60.6450 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.9200 (5)

2. Ventilation rate

						main heating	secondary heating	other		total	m3 per hour		
Number of chimneys						0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues						0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans												0 * 10 =	0.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans						= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)
Pressure test												Yes	
Measured/design AP50												4.3200	
Infiltration rate												0.2160	(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) =						0.1836	(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													
	0.2157	0.2020	0.2020	0.1836	0.1882	0.1790	0.1790	0.1744	0.1744	0.1882	0.1836	0.1882	(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)
front (Uw = 1.40)			14.5000	1.3258	19.2235		(27)
rear (Uw = 1.70)			0.5400	1.5918	0.8596		(27a)
ground			35.5000	0.1200	4.2600	75.0000	2662.5000 (28a)
external	99.0500	15.2000	83.8500	0.2700	22.6395	150.0000	12577.5004 (29a)
dormer	3.3000	1.4000	1.9000	0.3300	0.6270	9.0000	17.1000 (29a)
stud in roof	5.2800		5.2800	0.1300	0.6864	9.0000	47.5200 (29a)
cold	13.1000		13.1000	0.1100	1.4410	9.0000	117.9000 (30)
dormer	2.1000		2.1000	0.2000	0.4200	9.0000	18.9000 (30)
sloped	21.8300	0.5400	21.2900	0.1800	3.8322	9.0000	191.6100 (30)
cold	4.4000		4.4000	0.1300	0.5720	9.0000	39.6000 (30)
Total net area of external elements Aum(A, m ²)			184.5600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	56.6611			(33)
party			54.1000	0.0000	0.0000	45.0000	2434.4999 (32)
stud			141.2000			9.0000	1270.8000 (32c)
internal			66.6000			18.0000	1198.8000 (32d)
internal			66.6000			9.0000	599.4000 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				21176.1303 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							207.4058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5454 (36)
Total fabric heat loss			(33) + (36) =				66.2065 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan 39.5868	Feb 39.5868	Mar 39.5868	Apr 39.5868	May 39.5868	Jun 39.5868	Jul 39.5868	Aug 39.5868	Sep 39.5868	Oct 39.5868	Nov 39.5868	Dec 39.5868 (38)
Heat transfer coeff	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933	105.7933 (39)
Average = Sum(39)m / 12 =												105.7933 (39)
HLP	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362	1.0362 (40)
HLP (average)												1.0362 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Assumed occupancy												2.7581 (42)
Average daily hot water use (litres/day)												99.7057 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.6763	105.6880	101.6998	97.7116	93.7233	89.7351	89.7351	93.7233	97.7116	101.6998	105.6880	109.6763 (44)
Energy content (annual)	162.6467	142.2519	146.7912	127.9761	122.7961	105.9637	98.1910	112.6756	114.0213	132.8808	145.0498	157.5147 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1568.7586 (45)
	24.3970	21.3378	22.0187	19.1964	18.4194	15.8946	14.7286	16.9013	17.1032	19.9321	21.7575	23.6272 (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	14.1469	12.7667	14.1089	13.6129	14.0328	13.5410	13.9680	14.0100	13.5802	14.0755	13.6609	14.1346 (61)
Total heat required for water heating calculated for each month	176.7936	155.0185	160.9000	141.5890	136.8289	119.5047	112.1590	126.6856	127.6014	146.9563	158.7107	171.6493 (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												1.2915 (H8)
Utilisation factor												0.5390 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.7057 (H14)
Volume ratio Veff/V												0.7522 (H15)
Solar storage volume factor												0.9431 (H16)
Solar input	-29.5477	-42.0201	-72.9156	-98.0839	-113.9801	-123.9772	-117.5493	-107.1936	-83.9002	-57.9888	-34.9482	-905.5009 (H17)
Solar input												-23.3963 (63)
Solar input (sum of months) = Sum(63)m =												-905.5009 (63)
Output from w/h	147.2460	112.9985	87.9844	43.5052	22.8488	0.0000	0.0000	19.4920	43.7013	88.9675	123.7625	148.2530 (64)
Total per year (kWh/year) = Sum(64)m =												838.7590 (64)
Heat gains from water heating, kWh/month	57.6168	50.4904	52.3353	45.9553	44.3379	38.6182	36.1405	40.9671	41.3071	47.7017	51.6443	55.9073 (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	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880	165.4880 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.3199	54.4638	44.2930	33.5326	25.0660	21.1618	22.8661	29.7222	39.8930	50.6534	59.1200	63.0242 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	387.5801	391.6020	381.4670	359.8908	332.6548	307.0568	289.9557	285.9338	296.0688	317.6450	344.8810	370.4791 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069	54.3069 (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)	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254	-110.3254 (71)
Water heating gains (Table 5)	77.4419	75.1345	70.3431	63.8268	59.5940	53.6364	48.5759	55.0633	57.3710	64.1152	71.7282	75.1442 (72)
Total internal gains	638.8116	633.6700	608.5727	569.7199	529.7844	494.3245	473.8673	483.1890	505.8025	544.8832	588.1988	621.1171 (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	
Northeast					7.1500	14.6130		0.4500	0.0000	0.7700		36.2034 (75)	
Southeast					1.9000	45.0642		0.4500	0.0000	0.7700		29.6680 (77)	
Southwest					5.4500	45.0642		0.4500	0.0000	0.7700		85.1003 (79)	
Northeast					0.5400	21.2590		0.6300	0.7000	1.0000		4.5564 (82)	

Solar gains	155.5281	237.5578	363.6434	507.1416	580.9805	660.4861	602.9362	540.0108	431.4775	292.6622	188.2481	124.4224	(83)
Total gains	794.3397	871.2278	972.2161	1076.8615	1110.7649	1154.8106	1076.8035	1023.1998	937.2800	837.5454	776.4468	745.5395	(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	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014	55.6014
alpha	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068	4.7068
util living area	0.9823	0.9723	0.9398	0.8518	0.6916	0.4602	0.3231	0.3296	0.6031	0.8693	0.9636	0.9858 (86)
MIT	20.0754	20.1942	20.4511	20.7430	20.9264	20.9912	20.9987	20.9986	20.9704	20.7675	20.3861	20.0376 (87)
Th 2	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533	20.0533 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

MIT 2	0.9774	0.9649	0.9239	0.8154	0.6267	0.3780	0.2310	0.2328	0.5129	0.8267	0.9520	0.9818 (89)
Living area fraction	19.2336	19.3496	19.5967	19.8628	20.0103	20.0501	20.0531	20.0531	20.0407	19.8910	19.5387	19.1967 (90)
MIT	19.3523	19.4687	19.7172	19.9869	20.1395	20.1829	20.1865	20.1864	fLA = Living area / (4) =			0.1410 (91)
Temperature adjustment									20.1718	20.0146	19.6582	19.3153 (92)
adjusted MIT	19.2023	19.3187	19.5672	19.8369	19.9895	20.0329	20.0365	20.0364	20.0218	19.8646	19.5082	-0.1500
												19.1653 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9717	0.9576	0.9140	0.8060	0.6220	0.3762	0.2294	0.2311	0.5097	0.8167	0.9434	0.9768 (94)	
Useful gains	771.8741	834.2452	888.5815	867.9241	690.9446	434.4084	246.9946	236.4165	477.7479	683.9973	732.5278	728.2399 (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													
Month fracti	1439.0331	1409.0325	1266.0467	1030.1033	728.8645	437.2298	247.1815	236.6013	488.9577	821.4432	1154.0148	1424.5374 (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	496.3663	386.2570	280.8341	116.7690	28.2124	0.0000	0.0000	0.0000	0.0000	102.2597	303.4706	518.0453 (98)	
Space heating per m2												2232.2145 (98)	
												(98) / (4) =	21.8630 (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													2466.5354 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	496.3663	386.2570	280.8341	116.7690	28.2124	0.0000	0.0000	0.0000	0.0000	102.2597	303.4706	518.0453 (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)	548.4710	426.8033	310.3139	129.0265	31.1739	0.0000	0.0000	0.0000	0.0000	112.9942	335.3267	572.4258 (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	147.2460	112.9985	87.9844	43.5052	22.8488	0.0000	0.0000	19.4920	43.7013	88.9675	123.7625	148.2530 (64)	
Efficiency of water heater (217)m	89.7474	89.7554	89.7155	89.6084	89.0395	87.3000	87.3000	87.3000	87.3000	88.9825	89.5491	87.3000 (216)	
Fuel for water heating, kWh/month	164.0672	125.8961	98.0704	48.5503	25.6614	0.0000	0.0000	22.3276	50.0587	99.9831	138.2063	165.1515 (219)	
Water heating fuel used												937.9725 (219)	
Annual totals kWh/year													
Space heating fuel - main system												2466.5354 (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)													61.9318 (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													186.9318 (231)
Electricity for lighting (calculated in Appendix L)													433.1717 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 + 0.90 + 780 + 1.00) =										-561.9528			-561.9528 (233)
Total delivered energy for all uses													3462.6586 (238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2466.5354	9.7400	240.2405 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	937.9725	9.7400	91.3585 (247)	
Mechanical ventilation fans	61.9318	36.8500	22.8219 (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	433.1717	36.8500	159.6238 (250)	
Additional standing charges			104.0000 (251)	
Energy saving/generation technologies				
PV Unit	-561.9528	36.8500	-207.0796 (252)	
Total energy cost			457.0276 (255)	

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

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 kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2466.5354	0.2160	532.7716 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	937.9725	0.2160	202.6021 (264)
Space and water heating			735.3737 (265)
Pumps and fans	186.9318	0.5190	97.0176 (267)
Energy for lighting	433.1717	0.5190	224.8161 (268)
Energy saving/generation technologies			
PV Unit	-561.9528	0.5190	-291.6535 (269)
Total kg/year			765.5539 (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	2466.5354	1.2200	3009.1732 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	937.9725	1.2200	1144.3265 (264)
Space and water heating			4153.4997 (265)
Pumps and fans	186.9318	3.0700	573.8806 (267)
Energy for lighting	433.1717	3.0700	1329.8372 (268)
Energy saving/generation technologies			
PV Unit	-561.9528	3.0700	-1725.1951 (269)
Primary energy kWh/year			4332.0224 (272)
Primary energy kWh/m2/year			42.4292 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	207.4 (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	316.69 (P1)
Transmission heat loss coefficient	66.21 (P7)
Summer heat loss coefficient	382.90 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
North East	1.000	1.00	1.000	1.000 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	7.1500	106.0502	0.4500	0.0000	0.9000	307.0949
South East	1.9000	127.3119	0.4500	0.0000	0.9000	97.9665
South West	5.4500	127.3119	0.4500	0.0000	0.9000	281.0091
North East	0.5400	168.2607	0.6300	0.7000	1.0000	36.0626
total:						722.1331

	Jun	Jul	Aug	
Solar gains	779	722	633	(P3/P4)
Internal gains	491	471	480	
Total summer gains	1270	1193	1113	(P5)
Summer gain/loss ratio	3.32	3.12	2.91	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 207.4)	0.55	0.55	0.55	
Threshold temperature	19.26	20.96	20.76	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 21 Hamblewood	Issued on Date	18/05/2023
Assessment Reference	21 Hamblewood	Prop Type Ref	21809
Property	40 Alder Avenue, Hedge End, Southampton, SO30 0AS		
SAP Rating	88 B	DER	13.13
Environmental	89 B	% DER<TER	19.40
CO ₂ Emissions (t/year)	0.96	DFEE	42.89
General Requirements Compliance	Pass	% DFEE<TFEE	8.88
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk		Assessor ID
Client	Y128-0001		

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)	16.29	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.13	kgCO ₂ /m ²	Pass
	-3.16 (-19.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	47.07	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	42.89	kWh/m ² /yr	
	-4.2 (-8.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.33 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.15 (max. 0.20)	0.20 (max. 0.35)	Pass
Openings	1.36 (max. 2.00)	1.70 (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	4.32 (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 North East

7.15 m², No overhang

Windows facing South East

1.90 m², No overhang

Windows facing South West

5.45 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

4.32 (measured in this dwelling)

Maximum

10.0

Pass

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

10 Key features

External wall U-value	0.13	W/m ² K
Party wall U-value	0.00	W/m ² K
Roof U-value	0.11	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.00	W/m ² K
Photovoltaic array	0.90	kW

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