

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 20			Issued on Date	18/05/2023
Assessment Reference	20 Hamblewood	Prop Type Ref	21809		
Property	39 Alder Avenue , Hedge End, SOUTHAMPTON, SO30 0AS				
SAP Rating	88 B	DER	13.35	TER	16.48
Environmental	89 B	% DER<TER	18.99		
CO ₂ Emissions (t/year)	0.98	DFEE	43.76	TFEE	48.02
General Requirements Compliance	Pass	% DFEE<TFEE	8.87		
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) 16.48 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.35 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)43.8 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 West: 5.45 m², No overhang

Windows facing North West: 1.90 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)

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)			
Southwest				5.4500	36.7938	0.4500	0.0000	0.7700	69.4824 (79)			
Northwest				1.9000	11.2829	0.4500	0.0000	0.7700	7.4281 (81)			
Northeast				0.5400	16.3666	0.6300	0.7000	1.0000	3.5078 (82)			
Solar gains	108.3715	197.5934	305.0098	436.2231	541.9773	561.5759	531.6290	349.8633	227.7136	132.1677	91.2157 (83)	
Total gains	537.3921	624.2589	716.0250	821.9618	901.8484	896.7770	850.9936	775.0084	688.9296	592.2844	525.9861	507.1626 (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	0.9974	0.9944	0.9850	0.9517	0.8586	0.6933	0.5320	0.5998	0.8478	0.9742	0.9949	0.9980 (86)
MIT	19.6596	19.8210	20.0975	20.4578	20.7718	20.9398	20.9861	20.9763	20.8411	20.4301	19.9684	19.6156 (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	0.9967	0.9928	0.9806	0.9366	0.8163	0.6120	0.4247	0.4891	0.7859	0.9635	0.9932	0.9975 (89)
MIT 2	18.8215	18.9823	19.2564	19.6067	19.8926	20.0227	20.0490	20.0452	19.9570	19.5856	19.1298	18.7776 (90)
Living area fraction	18.9397	19.1006	19.3750	19.7267	20.0166	20.1521	20.1812	20.1765	20.0817	19.7047	19.2480	18.8958 (92)
Temperature adjustment	18.7897	18.9506	19.2250	19.5767	19.8666	20.0021	20.0312	20.0265	19.9317	19.5547	19.0980	-0.1500
adjusted MIT	1532.9172	1486.4570	1346.2183	1129.5241	863.9720	571.5020	362.9969	383.6578	616.9533	947.3502	1269.3115	1538.8503 (97)

8. Space heating requirement

Utilisation	0.9953	0.9902	0.9753	0.9271	0.8066	0.6073	0.4221	0.4857	0.7764	0.9559	0.9907	0.9964 (94)
Useful gains	534.8728	618.1148	698.3749	762.0614	727.4488	544.5763	359.1937	376.4490	534.8897	566.1581	521.0809	505.3286 (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	1532.9172	1486.4570	1346.2183	1129.5241	863.9720	571.5020	362.9969	383.6578	616.9533	947.3502	1269.3115	1538.8503 (97)

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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	742.5451	583.5260	481.9955	264.5732	101.5733	0.0000	0.0000	0.0000	0.0000	283.6069	538.7261	768.9401 (98)
Space heating												3765.4861 (98)
Space heating per m2										(98) / (4) =		36.8804 (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												4160.7581 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	742.5451	583.5260	481.9955	264.5732	101.5733	0.0000	0.0000	0.0000	0.0000	283.6069	538.7261	768.9401 (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)	820.4918	644.7801	532.5917	292.3460	112.2356	0.0000	0.0000	0.0000	0.0000	313.3778	595.2774	849.6576 (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	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	89.8665	89.8090	89.6773	89.3582	88.6353	87.3000	87.3000	87.3000	87.3000	89.3818	89.7514	87.3000 (216)
Fuel for water heating, kWh/month	196.7291	172.6091	179.4211	158.4511	154.3729	136.8897	128.4754	145.1152	146.1643	164.4142	176.8338	190.9364 (219)
Water heating fuel used												1950.4122 (219)
Annual totals kWh/year												
Space heating fuel - main system												4160.7581 (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												6194.1904 (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	4160.7581	0.2160	898.7238 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1950.4122	0.2160	421.2890 (264)
Space and water heating			1320.0128 (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			1363.1002 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3500 (273)

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

DER			13.3500 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			30.2354 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			30.2354 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)												
(38)m	Jan 47.6610	Feb 47.3475	Mar 47.0402	Apr 45.5967	May 45.3266	Jun 44.0694	Jul 44.0694	Aug 43.8366	Sep 44.5537	Oct 45.3266	Nov 45.8730	Dec 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	Jan 1.0467	Feb 1.0436	Mar 1.0406	Apr 1.0265	May 1.0238	Jun 1.0115	Jul 1.0115	Aug 1.0092	Sep 1.0162	Oct 1.0238	Nov 1.0292	Dec 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

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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)
Southwest					5.4500	36.7938	0.6300	0.7000	0.7700					61.2835 (79)
Northwest					1.9000	11.2829	0.6300	0.7000	0.7700					6.5516 (81)
Northeast					0.5400	16.3666	0.6300	0.7000	1.0000					3.5078 (82)

Solar gains	95.9976	175.1293	270.5899	387.4011	481.6572	499.2131	472.5362	398.9728	310.5157	201.8928	117.0941			80.7896 (83)
Total gains	537.3878	614.1685	693.9875	785.1446	852.8614	845.0781	802.5729	736.2135	661.5981	578.8572	523.2924	509.1102	(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	0.9990	0.9976	0.9928	0.9716	0.8963	0.7281	0.5556	0.6231	0.8788	0.9854	0.9977	0.9992 (86)
MIT	19.8302	19.9656	20.2008	20.5246	20.8044	20.9569	20.9920	20.9856	20.8732	20.5135	20.1173	19.8103 (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	0.9986	0.9968	0.9902	0.9605	0.8570	0.6436	0.4442	0.5083	0.8182	0.9778	0.9968	0.9990 (89)
MIT 2	18.4712	18.6708	19.0154	19.4886	19.8658	20.0442	20.0707	20.0694	19.9620	19.4799	18.9018	18.4493 (90)
Living area fraction	18.6629	18.8534	19.1826	19.6347	19.9982	20.1729	20.2006	20.1986	20.0905	19.6257	19.0733	18.6413 (91)
MIT	18.6629	18.8534	19.1826	19.6347	19.9982	20.1729	20.2006	20.1986	20.0905	19.6257	19.0733	18.6413 (92)
Temperature adjustment	18.6629	18.8534	19.1826	19.6347	19.9982	20.1729	20.2006	20.1986	20.0905	19.6257	19.0733	18.6413 (93)
adjusted MIT	18.6629	18.8534	19.1826	19.6347	19.9982	20.1729	20.2006	20.1986	20.0905	19.6257	19.0733	18.6413 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9978	0.9952	0.9868	0.9539	0.8537	0.6533	0.4599	0.5242	0.8198	0.9728	0.9953	0.9984	(94)
Useful gains	536.2080	611.2100	684.8060	748.9807	728.1255	552.1147	369.0979	385.9531	542.3835	563.1357	520.8271	508.2755	(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	1534.8888	1486.7624	1347.4510	1125.0033	867.4177	575.5356	371.8487	391.4108	621.5615	943.4651	1258.1151	1525.6980	(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	743.0186	588.3712	493.0079	270.7363	103.6334	0.0000	0.0000	0.0000	0.0000	282.9651	530.8474	756.9624	(98)
Space heating												3769.5422	(98)
Space heating per m2												(98) / (4) = 36.9201	(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												4035.9124 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	743.0186	588.3712	493.0079	270.7363	103.6334	0.0000	0.0000	0.0000	0.0000	282.9651	530.8474	756.9624 (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)	795.5231	629.9478	527.8457	289.8676	110.9565	0.0000	0.0000	0.0000	0.0000	302.9605	568.3591	810.4522 (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	87.9305	87.7251	87.2580	86.1297	83.8404	80.3000	80.3000	80.3000	80.3000	86.1334	87.4520	80.3000 (216)
Fuel for water heating, kWh/month	242.9256	214.6241	226.6268	204.5319	203.4299	187.0693	179.2266	199.7957	202.0022	213.4360	222.2532	236.8758 (219)
Water heating fuel used												2532.7972 (219)
Annual totals kWh/year												
Space heating fuel - main system												4035.9124 (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												7076.8814 (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	4035.9124	0.2160	871.7571 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2532.7972	0.2160	547.0842 (264)
Space and water heating			1418.8413 (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			1682.5824 (272)
Emissions per m2 for space and water heating			13.8966 (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) = (13.8966 * 1.00) + 2.2019 + 0.3812, rounded to 2 d.p.			16.4800 (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 * 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) =				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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	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)
HLP (average)												1.0858 (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		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)	
Southwest				5.4500	36.7938	0.4500		0.0000		0.7700		69.4824 (79)	
Northwest				1.9000	11.2829	0.4500		0.0000		0.7700		7.4281 (81)	
Northeast				0.5400	16.3666	0.6300		0.7000		1.0000		3.5078 (82)	
Solar gains	108.3715	197.5934	305.0098	436.2231	541.9773	561.5759	531.6290	449.1085	349.8633	227.7136	132.1677	91.2157 (83)	
Total gains	503.4050	591.1072	684.6082	792.9058	874.3273	871.4147	827.4628	749.1273	662.2107	563.1223	494.0678	474.0074 (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	0.9980	0.9956	0.9881	0.9602	0.8794	0.7220	0.5611	0.6318	0.8714	0.9798	0.9961	0.9985	(86)
MIT	19.5204	19.6892	19.9803	20.3749	20.7197	20.9221	20.9807	20.9677	20.8037	20.3544	19.8668	19.4923	(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	0.9974	0.9943	0.9844	0.9471	0.8398	0.6393	0.4466	0.5153	0.8133	0.9710	0.9947	0.9981	(89)
MIT 2	18.6396	18.8096	19.1004	19.4941	19.8142	19.9827	20.0168	20.0131	19.8981	19.4808	18.9951	18.6181	(90)
Living area fraction	fLA = Living area / (4) = 0.1410 (91)												
MIT	18.7639	18.9336	19.2245	19.6184	19.9419	20.1152	20.1527	20.1478	20.0258	19.6040	19.1180	18.7414	(92)
Temperature adjustment	0.0000												
adjusted MIT	18.7639	18.9336	19.2245	19.6184	19.9419	20.1152	20.1527	20.1478	20.0258	19.6040	19.1180	18.7414	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9923	0.9805	0.9406	0.8364	0.6478	0.4625	0.5310	0.8137	0.9660	0.9930	0.9973	(94)
Useful gains	501.6008	586.5746	671.2649	745.8059	731.3054	564.4877	382.6635	397.8121	538.8552	543.9899	490.6072	472.7084	(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	1628.6864	1576.5304	1426.1593	1188.2658	911.8392	604.3195	389.2890	409.9229	651.7345	996.1600	1335.1496	1622.4885	(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	838.5517	665.2503	561.6415	318.5711	134.3171	0.0000	0.0000	0.0000	0.0000	336.4146	608.0705	855.4364	(98)
Space heating	4318.2532 (98)												
Space heating per m2	(98) / (4) = 42.2944 (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	0.8533	0.9127	0.8807	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	878.8484	740.0971	732.1131	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1119.7651	1066.5139	978.1491	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	173.4600	242.8541	183.0508	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling														
Cooled fraction									FC = cooled area / (4) =			599.3649	(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	43.3650	60.7135	45.7627	0.0000	0.0000	0.0000	0.0000	(107)	
Space cooling													149.8412	(107)
Space cooling per m2													1.4676	(108)
Energy for space heating													42.2944	(99)
Energy for space cooling													1.4676	(108)
Total													43.7619	(109)
Dwelling Fabric Energy Efficiency (DFEE)													43.8	(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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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)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)
Southwest			5.4500		36.7938		0.6300		0.7000		0.7700		61.2835 (79)
Northwest			1.9000		11.2829		0.6300		0.7000		0.7700		6.5516 (81)
Northeast			0.5400		16.3666		0.6300		0.7000		1.0000		3.5078 (82)
Solar gains	95.9976	175.1293	270.5899	387.4011	481.6572	499.2131	472.5362	398.9728	310.5157	201.8928	117.0941		80.7896 (83)
Total gains	491.0311	568.6431	650.1883	744.0838	814.0071	809.0519	768.3700	698.9915	622.8631	537.3015	478.9942		463.5814 (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	0.9993	0.9983	0.9947	0.9774	0.9110	0.7511	0.5781	0.6511	0.8998	0.9896	0.9985	0.9995 (86)
MIT	19.7869	19.9234	20.1611	20.4911	20.7829	20.9497	20.9903	20.9822	20.8534	20.4771	20.0761	19.7677 (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	0.9991	0.9978	0.9927	0.9682	0.8752	0.6672	0.4633	0.5336	0.8451	0.9840	0.9979	0.9994 (89)
MIT 2	18.9272	19.0654	19.3043	19.6386	19.9112	20.0497	20.0712	20.0702	19.9821	19.6300	19.2279	18.9160 (90)
Living area fraction	19.0484	19.1864	19.4252	19.7588	20.0341	20.1767	20.2008	20.1988	20.1050	19.7494	19.3476	19.0361 (92)
Temperature adjustment	19.0484	19.1864	19.4252	19.7588	20.0341	20.1767	20.2008	20.1988	20.1050	19.7494	19.3476	19.0361 (93)
adjusted MIT	19.0484	19.1864	19.4252	19.7588	20.0341	20.1767	20.2008	20.1988	20.1050	19.7494	19.3476	19.0361 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	490.4251	566.9537	644.3181	717.6405	711.3454	548.0049	368.4875	384.5370	527.9373	527.3175	477.6796	463.1665 (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	1576.0944	1522.2438	1373.2275	1138.0128	871.1736	575.9217	371.8679	391.4360	623.0654	956.3977	1286.9389	1567.4106 (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	807.7380	641.9549	542.3086	302.6680	118.9122	0.0000	0.0000	0.0000	0.0000	319.2356	582.6667	821.5576 (98)
Space heating												
Space heating per m2	(98) / (4) = 40.5195 (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												

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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	0.8780	0.9359	0.9074	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	852.3740	715.2730	710.5587	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1046.8735	997.4443	919.5490	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	140.0396	209.9355	155.4888	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			505.4639 (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	35.0099	52.4839	38.8722	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												126.3660 (107)
Energy for space heating												1.2377 (108)
Energy for space cooling												40.5195 (99)
Total												1.2377 (108)
Target Fabric Energy Efficiency (TFEE)												41.7572 (109)
												48.0 (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)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.2157	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)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	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)
Water storage loss:	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)
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)
												1734 (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 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)
Southwest				5.4500	45.0642	0.4500		0.0000		0.7700		85.1003 (79)
Northwest				1.9000	14.6130	0.4500		0.0000		0.7700		9.6205 (81)
Northeast				0.5400	21.2590	0.6300		0.7000		1.0000		4.5564 (82)
Solar gains	135.4806	211.3457	334.5640	482.9055	565.2552	647.8564	589.3901	519.3928	402.7695	263.5583	164.9292	107.8003 (83)
Total gains	774.2922	845.0157	943.1367	1052.6254	1095.0396	1142.1809	1063.2574	1002.5818	908.5720	808.4415	753.1280	728.9173 (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	0.9839	0.9752	0.9455	0.8602	0.6988	0.4650	0.3272	0.3363	0.6188	0.8813	0.9674	0.9870 (86)
MIT	20.0553	20.1692	20.4273	20.7302	20.9231	20.9908	20.9986	20.9985	20.9671	20.7505	20.3647	20.0207 (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	0.9795	0.9685	0.9308	0.8249	0.6340	0.3820	0.2340	0.2376	0.5275	0.8408	0.9568	0.9833 (89)
MIT 2	19.2140	19.3254	19.5745	19.8522	20.0082	20.0500	20.0531	20.0531	20.0391	19.8773	19.5184	19.1801 (90)
Living area fraction	19.3327	19.4444	19.6948	19.9760	20.1373	20.1827	20.1864	20.1864	20.1700	20.0004	19.6378	0.1410 (91)
MIT	19.1827	19.2944	19.5448	19.8260	19.9873	20.0327	20.0364	20.0364	20.0200	19.8504	19.4878	19.1487 (93)
Temperature adjustment												-0.1500
adjusted MIT												19.1487 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9741	0.9616	0.9211	0.8153	0.6291	0.3802	0.2323	0.2358	0.5241	0.8305	0.9486	0.9786 (94)
Ext temp.	754.2592	812.5815	868.7690	858.1601	688.9067	434.2595	246.9817	236.3956	476.1994	671.4452	714.4151	713.3092 (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	1436.9541	1406.4620	1263.6798	1028.9468	728.6256	437.2108	247.1793	236.5977	488.7676	819.9415	1151.8551	1422.7797	(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	507.9250	399.0877	293.8136	122.9664	29.5509	0.0000	0.0000	0.0000	0.0000	110.4812	314.9568	527.8460	(98)
RHI space heating demand												2306.6276	(98)
												2307	(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												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)
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 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)	
Southwest				5.4500	36.7938	0.4500		0.0000	0.7700		69.4824 (79)	
Northwest				1.9000	11.2829	0.4500		0.0000	0.7700		7.4281 (81)	
Northeast				0.5400	16.3666	0.6300		0.7000	1.0000		3.5078 (82)	
Solar gains	108.3715	197.5934	305.0098	436.2231	541.9773	561.5759	531.6290	449.1085	349.8633	227.7136	132.1677	91.2157 (83)
Total gains	747.1831	831.2634	913.5825	1005.9430	1071.7617	1055.9005	1005.4963	932.2975	855.6658	772.5969	720.3665	712.3328 (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	0.9899	0.9822	0.9628	0.9078	0.7877	0.6104	0.4562	0.5100	0.7536	0.9350	0.9820	0.9919 (86)
MIT	19.8813	20.0342	20.2873	20.6004	20.8479	20.9645	20.9927	20.9878	20.9073	20.5884	20.1688	19.8338 (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	0.9872	0.9776	0.9529	0.8836	0.7371	0.5315	0.3614	0.4107	0.6805	0.9124	0.9764	0.9897 (89)
MIT 2	19.0416	19.1924	19.4398	19.7362	19.9513	20.0362	20.0511	20.0494	20.0015	19.7318	19.3269	18.9945 (90)
Living area fraction												fLA = Living area / (4) = 0.1410 (91)
MIT	19.1600	19.3111	19.5593	19.8581	20.0777	20.1671	20.1839	20.1817	20.1292	19.8526	19.4456	19.1129 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0100	19.1611	19.4093	19.7081	19.9277	20.0171	20.0339	20.0317	19.9792	19.7026	19.2956	18.9629 (93)

8. Space heating requirement

Utilisation	0.9833	0.9719	0.9445	0.8731	0.7297	0.5283	0.3594	0.4084	0.6741	0.9020	0.9705	0.9863 (94)
Useful gains	734.7037	807.9138	862.8906	878.3216	782.0771	557.8644	361.3549	380.7078	576.8147	696.9039	699.1230	702.5962 (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	1556.2199	1508.7290	1365.7226	1143.4253	870.4380	573.0946	363.2861	384.2121	621.9841	962.9980	1290.2139	1561.8120 (97)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	611.2080	470.9478	374.1070	190.8746	65.7406	0.0000	0.0000	0.0000	0.0000	197.9740	425.5855	639.2565 (98)
Space heating												2975.6941 (98)
Space heating per m2										(98) / (4) =		29.1449 (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												3288.0598 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	611.2080	470.9478	374.1070	190.8746	65.7406	0.0000	0.0000	0.0000	0.0000	197.9740	425.5855	639.2565 (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)	675.3680	520.3844	413.3779	210.9112	72.6415	0.0000	0.0000	0.0000	0.0000	218.7558	470.2602	706.3608 (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	89.7618	89.6859	89.5132	89.1090	88.3134	87.3000	87.3000	87.3000	87.3000	89.1084	89.6078	87.3000 (216)
Fuel for water heating, kWh/month	196.9586	172.8461	179.7500	158.8943	154.9356	136.8897	128.4754	145.1152	146.1643	164.9185	177.1170	191.1393 (219)
Water heating fuel used												1953.2040 (219)
Annual totals kWh/year												
Space heating fuel - main system												3288.0598 (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												5324.2838 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3288.0598	3.4800	114.4245 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1953.2040	3.4800	67.9715 (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			313.3463 (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] =	0.8947 (257)
SAP value		87.5194
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	3288.0598	0.2160	710.2209 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1953.2040	0.2160	421.8921 (264)
Space and water heating			1132.1130 (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			1175.2004 (272)
CO2 emissions per m2			11.5100 (273)
EI value			89.2946
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	$3.48 / 0.8868 = 3.924$, stars = 4
Water heating environmental impact	$0.216 / 0.8868 = 0.2436$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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 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)
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		or Table 6b		or Table 6c		Table 6d		W		
Northeast	7.1500	14.6130		0.4500		0.0000		0.7700		36.2034 (75)		
Southwest	5.4500	45.0642		0.4500		0.0000		0.7700		85.1003 (79)		
Northwest	1.9000	14.6130		0.4500		0.0000		0.7700		9.6205 (81)		
Northeast	0.5400	21.2590		0.6300		0.7000		1.0000		4.5564 (82)		
Solar gains	135.4806	211.3457	334.5640	482.9055	565.2552	647.8564	589.3901	519.3928	402.7695	263.5583	164.9292	107.8003 (83)
Total gains	774.2922	845.0157	943.1367	1052.6254	1095.0396	1142.1809	1063.2574	1002.5818	908.5720	808.4415	753.1280	728.9173 (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	0.9839	0.9752	0.9455	0.8602	0.6988	0.4650	0.3272	0.3363	0.6188	0.8813	0.9674	0.9870 (86)
MIT	20.0553	20.1692	20.4273	20.7302	20.9231	20.9908	20.9986	20.9985	20.9671	20.7505	20.3647	20.0207 (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	0.9795	0.9685	0.9308	0.8249	0.6340	0.3820	0.2340	0.2376	0.5275	0.8408	0.9568	0.9833 (89)
MIT 2	19.2140	19.3254	19.5745	19.8522	20.0082	20.0500	20.0531	20.0531	20.0391	19.8773	19.5184	19.1801 (90)
Living area fraction	19.3327	19.4444	19.6948	19.9760	20.1373	20.1827	20.1864	20.1864	20.1700	20.0004	19.6378	19.2987 (92)
Temperature adjustment	19.1827	19.2944	19.5448	19.8260	19.9873	20.0327	20.0364	20.0364	20.0200	19.8504	19.4878	-0.1500
adjusted MIT	19.1827	19.2944	19.5448	19.8260	19.9873	20.0327	20.0364	20.0364	20.0200	19.8504	19.4878	19.1487 (93)
8. Space heating requirement												
Utilisation	0.9741	0.9616	0.9211	0.8153	0.6291	0.3802	0.2323	0.2358	0.5241	0.8305	0.9486	0.9786 (94)
Useful gains	754.2592	812.5815	868.7690	858.1601	688.9067	434.2595	246.9817	236.3956	476.1994	671.4452	714.4151	713.3092 (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	1436.9541	1406.4620	1263.6798	1028.9468	728.6256	437.2108	247.1793	236.5977	488.7676	819.9415	1151.8551	1422.7797 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	507.9250	399.0877	293.8136	122.9664	29.5509	0.0000	0.0000	0.0000	0.0000	110.4812	314.9568	527.8460 (98)
Space heating												2306.6276 (98)
Space heating per m2											(98) / (4) =	22.5918 (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												2548.7598 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	507.9250	399.0877	293.8136	122.9664	29.5509	0.0000	0.0000	0.0000	0.0000	110.4812	314.9568	527.8460 (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)	561.2431	440.9808	324.6559	135.8745	32.6529	0.0000	0.0000	0.0000	0.0000	122.0787	348.0185	583.2553 (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	89.6515	89.5814	89.3412	88.7588	87.8517	87.3000	87.3000	87.3000	87.3000	88.6452	89.4020	87.3000 (216)
Fuel for water heating, kWh/month	197.2009	173.0478	180.0961	159.5212	155.7498	136.8897	128.4754	145.1152	146.1643	165.7804	177.5248	191.3737 (219)
Water heating fuel used												1956.9392 (219)
Annual totals kWh/year												
Space heating fuel - main system												2548.7598 (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												4513.8498 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2548.7598	9.7400	248.2492 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1956.9392	9.7400	190.6059 (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			545.8586 (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	2548.7598	0.2160	550.5321 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1956.9392	0.2160	422.6989 (264)
Space and water heating			973.2310 (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			977.4612 (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	2548.7598	1.2200	3109.4870 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1956.9392	1.2200	2387.4659 (264)
Space and water heating			5496.9529 (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			5521.9756 (272)
Primary energy kWh/m2/year			54.0840 (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 (19.9%)

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	£543	£444	£99
Space heating	£403	£403	£0
Water heating	£191	£110	£81
Lighting	£160	£160	£0
Generated (PV)	-£207	-£207	£0
Total cost of fuels	£546	£466	£81
Total cost of uses	£547	£466	£81
Delivered energy	44 kWh/m²	35 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	54 kWh/m²	43 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)	
Southwest			5.4500	36.7938		0.4500		0.0000		0.7700		69.4824 (79)	
Northwest			1.9000	11.2829		0.4500		0.0000		0.7700		7.4281 (81)	
Northeast			0.5400	16.3666		0.6300		0.7000		1.0000		3.5078 (82)	

Solar gains	108.3715	197.5934	305.0098	436.2231	541.9773	561.5759	531.6290	449.1085	349.8633	227.7136	132.1677	91.2157 (83)	
Total gains	747.1831	831.2634	913.5825	1005.9430	1071.7617	1055.9005	1005.4963	932.2975	855.6658	772.5969	720.3665	712.3328 (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	0.9899	0.9822	0.9628	0.9078	0.7877	0.6104	0.4562	0.5100	0.7536	0.9350	0.9820	0.9919 (86)
MIT	19.8813	20.0342	20.2873	20.6004	20.8479	20.9645	20.9927	20.9878	20.9073	20.5884	20.1688	19.8338 (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												

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	0.9872	0.9776	0.9529	0.8836	0.7371	0.5315	0.3614	0.4107	0.6805	0.9124	0.9764	0.9897 (89)
Living area fraction	19.0416	19.1924	19.4398	19.7362	19.9513	20.0362	20.0511	20.0494	20.0015	19.7318	19.3269	18.9945 (90)
MIT	19.1600	19.3111	19.5593	19.8581	20.0777	20.1671	20.1839	20.1817	fLA = Living area / (4) =			0.1410 (91)
Temperature adjustment									20.1292	19.8526	19.4456	19.1129 (92)
adjusted MIT	19.0100	19.1611	19.4093	19.7081	19.9277	20.0171	20.0339	20.0317	19.9792	19.7026	19.2956	-0.1500
												18.9629 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9833	0.9719	0.9445	0.8731	0.7297	0.5283	0.3594	0.4084	0.6741	0.9020	0.9705	0.9863 (94)	
Useful gains	734.7037	807.9138	862.8906	878.3216	782.0771	557.8644	361.3549	380.7078	576.8147	696.9039	699.1230	702.5962 (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	1556.2199	1508.7290	1365.7226	1143.4253	870.4380	573.0946	363.2861	384.2121	621.9841	962.9980	1290.2139	1561.8120 (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	611.2080	470.9478	374.1070	190.8746	65.7406	0.0000	0.0000	0.0000	0.0000	197.9740	425.5855	639.2565 (98)	
Space heating per m2												2975.6941 (98)	
												(98) / (4) =	29.1449 (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													3288.0598 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	611.2080	470.9478	374.1070	190.8746	65.7406	0.0000	0.0000	0.0000	0.0000	197.9740	425.5855	639.2565 (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)	675.3680	520.3844	413.3779	210.9112	72.6415	0.0000	0.0000	0.0000	0.0000	218.7558	470.2602	706.3608 (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	89.8457	89.8631	89.8661	89.8668	89.7917	87.3000	87.3000	87.3000	87.3000	89.4513	89.7360	87.3000 (216)	
Fuel for water heating, kWh/month	168.6738	125.6219	99.1991	50.5470	20.0757	3.0961	0.0000	29.7638	55.8211	104.0763	143.4915	167.4839 (219)	
Water heating fuel used												967.8501 (219)	
Annual totals kWh/year													
Space heating fuel - main system													3288.0598 (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			-487.0835 (233)
Total delivered energy for all uses													4388.9299 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3288.0598	3.4800	114.4245 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	967.8501	3.4800	33.6812 (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			285.6510 (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) x (256)] / [(4) + 45.0] = 0.8156 (257)
SAP value 88.6225
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	3288.0598	0.2160	710.2209 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	967.8501	0.2160	209.0556 (264)
Space and water heating			919.2765 (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			988.3139 (272)
CO2 emissions per m2			9.6800 (273)
EI value			90.9970
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
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)	

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)
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 =												838.7590 (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 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)
Southwest					5.4500	45.0642		0.4500	0.0000	0.7700		85.1003 (79)
Northwest					1.9000	14.6130		0.4500	0.0000	0.7700		9.6205 (81)
Northeast					0.5400	21.2590		0.6300	0.7000	1.0000		4.5564 (82)

Solar gains	135.4806	211.3457	334.5640	482.9055	565.2552	647.8564	589.3901	519.3928	402.7695	263.5583	164.9292	107.8003 (83)
Total gains	774.2922	845.0157	943.1367	1052.6254	1095.0396	1142.1809	1063.2574	1002.5818	908.5720	808.4415	753.1280	728.9173 (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	0.9839	0.9752	0.9455	0.8602	0.6988	0.4650	0.3272	0.3363	0.6188	0.8813	0.9674	0.9870 (86)
MIT	20.0553	20.1692	20.4273	20.7302	20.9231	20.9908	20.9986	20.9985	20.9671	20.7505	20.3647	20.0207 (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	0.9795	0.9685	0.9308	0.8249	0.6340	0.3820	0.2340	0.2376	0.5275	0.8408	0.9568	0.9833 (89)
Living area fraction	19.2140	19.3254	19.5745	19.8522	20.0082	20.0500	20.0531	20.0531	20.0391	19.8773	19.5184	19.1801 (90)
MIT	19.3327	19.4444	19.6948	19.9760	20.1373	20.1827	20.1864	20.1864	fLA = Living area / (4) =			0.1410 (91)
Temperature adjustment									20.1700	20.0004	19.6378	19.2987 (92)
adjusted MIT	19.1827	19.2944	19.5448	19.8260	19.9873	20.0327	20.0364	20.0364	20.0200	19.8504	19.4878	-0.1500
												19.1487 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9741	0.9616	0.9211	0.8153	0.6291	0.3802	0.2323	0.2358	0.5241	0.8305	0.9486	0.9786 (94)	
Useful gains	754.2592	812.5815	868.7690	858.1601	688.9067	434.2595	246.9817	236.3956	476.1994	671.4452	714.4151	713.3092 (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	1436.9541	1406.4620	1263.6798	1028.9468	728.6256	437.2108	247.1793	236.5977	488.7676	819.9415	1151.8551	1422.7797 (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	507.9250	399.0877	293.8136	122.9664	29.5509	0.0000	0.0000	0.0000	0.0000	110.4812	314.9568	527.8460 (98)	
Space heating per m2												2306.6276 (98)	
												(98) / (4) =	22.5918 (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													2548.7598 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	507.9250	399.0877	293.8136	122.9664	29.5509	0.0000	0.0000	0.0000	0.0000	110.4812	314.9568	527.8460 (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)	561.2431	440.9808	324.6559	135.8745	32.6529	0.0000	0.0000	0.0000	0.0000	122.0787	348.0185	583.2553 (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	89.7605	89.7739	89.7419	89.6413	89.0763	87.3000	87.3000	87.3000	87.3000	89.0441	89.5738	87.3000 (216)	
Fuel for water heating, kWh/month	164.0431	125.8701	98.0415	48.5325	25.6509	0.0000	0.0000	22.3276	50.0587	99.9140	138.1683	165.1321 (219)	
Water heating fuel used												937.7387 (219)	
Annual totals kWh/year													
Space heating fuel - main system												2548.7598 (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													3544.6493 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2548.7598	9.7400	248.2492 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	937.7387	9.7400	91.3358 (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			465.0135 (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	2548.7598	0.2160	550.5321 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	937.7387	0.2160	202.5516 (264)
Space and water heating			753.0837 (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			783.2639 (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	2548.7598	1.2200	3109.4870 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	937.7387	1.2200	1144.0413 (264)
Space and water heating			4253.5282 (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			4432.0509 (272)
Primary energy kWh/m2/year			43.4089 (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 (37)
Summer heat loss coefficient	382.90 (P2)

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

[Jul]	Area m2	Solar flux Table 6a W/m2	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 West	5.4500	127.3119	0.4500	0.0000	0.9000	281.0091
North West	1.9000	106.0502	0.4500	0.0000	0.9000	81.6056
North East	0.5400	168.2607	0.6300	0.7000	1.0000	36.0626

total: 705.7723

	Jun	Jul	Aug	
Solar gains	764	706	609	(P3/P4)
Internal gains	491	471	480	
Total summer gains	1255	1177	1089	(P5)
Summer gain/loss ratio	3.28	3.07	2.84	(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	19.23	20.92	20.69	(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 20	Issued on Date	18/05/2023
Assessment Reference	20 Hamblewood	Prop Type Ref	21809
Property	39 Alder Avenue , Hedge End, SOUTHAMPTON, SO30 0AS		
SAP Rating	88 B	DER	13.35
Environmental	89 B	TER	16.48
CO ₂ Emissions (t/year)	0.98	% DER<TER	18.99
General Requirements Compliance	Pass	DFEE	43.76
		TFEE	48.02
		% DFEE<TFEE	8.87
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk		Assessor ID
			Y128-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.48	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.35	kgCO ₂ /m ²	Pass
	-3.13 (-19.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.02	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.76	kWh/m ² /yr	
	-4.2 (-8.8%)	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 West

5.45 m², No overhang

Windows facing North West

1.90 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.