



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 5 Fred Woolley Walk
West End, Southampton, SO30 3LF

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
tobiaswhiting26@gmail.com

Report Issue Date: 18/03/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

THERMAL BRIDGING

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 67	Issued on Date	18/03/2022
Assessment Reference	As Built	Prop Type Ref	Lh
Property	5 Fred Woolley Walk, West End, Southampton, SO30 3LF		

SAP Rating	88 B	DER	13.75	TER	18.02
Environmental	88 B	% DER<TER	23.71		
CO ₂ Emissions (t/year)	1.14	DFEE	49.18	TFEE	61.58
General Requirements Compliance	Pass	% DFEE<TFEE	20.14		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
------------------	--	-------------	-----------

Client	Foreman Homes, FORE
--------	---------------------

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	1.83	0.13	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.01	0.07	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	8.40	0.56	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	3.02	0.21	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	7.08	0.45	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	17.31	0.36	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	42.90	0.69	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.060	33.56	2.01	CBA - 302
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	33.56	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	18.84	1.13	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	14.72	0.65	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	25.25	0.98	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	5.05	-0.46	Knauf P24

Total: **6.79** W/mK:
Y-Value: **0.024** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 67				Issued on Date	18/03/2022
Assessment Reference	As Built	Prop Type Ref	Lh			
Property	5 Fred Woolley Walk, West End, Southampton, SO30 3LF					
SAP Rating	88 B	DER	13.75	TER	18.02	
Environmental	88 B	% DER<TER	23.71			
CO ₂ Emissions (t/year)	1.14	DFEE	49.18	TFEE	61.58	
General Requirements Compliance	Pass	% DFEE<TFEE	20.14			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Detached House, total floor area 117 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.02 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.75 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (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: 4.01 (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
Worcester Greenstar 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% 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

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing North: 5.76 m², No overhang
Windows facing East: 11.48 m², No overhang
Windows facing West: 9.46 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.14 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6700 (1b)	x 2.3900 (2b)	= 140.2213 (1b) - (3b)
First floor	58.6700 (1c)	x 2.6800 (2c)	= 157.2356 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.4569 (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) =					40.0000 / (5) = 0.1345 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3350 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3350 (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	0.4271	0.4187	0.4103	0.3685	0.3601	0.3182	0.3182	0.3099	0.3350	0.3601	0.3768	0.3936 (22b)
Effective ac	0.5912	0.5877	0.5842	0.5679	0.5648	0.5506	0.5506	0.5480	0.5561	0.5648	0.5710	0.5775 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			26.7000	1.1450	30.5725		(27)
Ground Floor			58.6700	0.1200	7.0404	84.0000	4928.2800 (28a)
Brick and Block	170.1500	28.8200	141.3300	0.2400	33.9192	42.2200	5966.9526 (29a)
Pitched Roof	58.6700		58.6700	0.1000	5.8670	9.1000	533.8970 (30)
Total net area of external elements Aum(A, m ²)			287.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7311		(33)
GF Block			57.8100			75.0000	4335.7500 (32c)
GF Stud			34.4900			9.0000	310.4100 (32c)
FF Stud			125.9700			9.0000	1133.7300 (32c)
Internal Floor 1			58.6700			18.0000	1056.0600 (32d)
Internal Ceiling 1			58.6700			18.0000	1056.0600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19321.1396 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							164.6594 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7939 (36)
Total fabric heat loss						(33) + (36) =	86.5250 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	58.0330	57.6853	57.3446	55.7441	55.4446	54.0506	54.0506	53.7925	54.5876	55.4446	56.0504	56.6837 (38)
Average = Sum(39)m / 12 =	144.5580	144.2104	143.8696	142.2691	141.9696	140.5756	140.5756	140.3175	141.1126	141.9696	142.5754	143.2088 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2320	1.2290	1.2261	1.2125	1.2099	1.1980	1.1980	1.1958	1.2026	1.2099	1.2151	1.2205 (40)
HLP (average)												1.2124 (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												2.8524 (42)
Average daily hot water use (litres/day)												101.9451 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1396	108.0618	103.9840	99.9062	95.8284	91.7505	91.7505	95.8284	99.9062	103.9840	108.0618	112.1396 (44)
Energy conte	166.2997	145.4468	150.0881	130.8504	125.5541	108.3436	100.3963	115.2062	116.5822	135.8653	148.3076	161.0524 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9927 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9450	21.8170	22.5132	19.6276	18.8331	16.2515	15.0594	17.2809	17.4873	20.3798	22.2461	24.1579 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8655	170.3433	177.6405	157.4949	153.0616	134.9348	127.8558	142.6968	143.2024	163.3940	174.9702	188.6099 (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	193.8655	170.3433	177.6405	157.4949	153.0616	134.9348	127.8558	142.6968	143.2024	163.3940	174.9702	188.6099 (64)
Heat gains from water heating, kWh/month	62.1861	54.5852	56.7924	50.1689	48.6236	42.6721	40.2467	45.1787	45.4186	52.0574	55.9779	60.4393 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1928.0698 (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	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1145	22.3065	18.1409	13.7338	10.2662	8.6671	9.3652	12.1732	16.3388	20.7459	24.2135	25.8125	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7087	284.6319	277.2654	261.5830	241.7868	223.1811	210.7514	207.8281	215.1946	230.8770	250.6733	269.2789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	(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)	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	(71)
Water heating gains (Table 5)	83.5835	81.2280	76.3339	69.6790	65.3543	59.2667	54.0950	60.7241	63.0814	69.9696	77.7471	81.2356	(72)
Total internal gains	459.1930	456.9528	440.5265	413.7822	386.1936	359.9013	342.9978	349.5117	363.4012	390.3789	421.4203	445.1135	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				5.7600	10.6334		0.6300	0.7000	0.7700		18.7183 (74)	
East				11.4800	19.6403		0.6300	0.7000	0.7700		68.9066 (76)	
West				9.4600	19.6403		0.6300	0.7000	0.7700		56.7819 (80)	
Solar gains	144.4069	281.6451	465.7034	688.1856	855.2653	881.6783	836.8012	710.1747	544.0201	334.3311	179.8103	118.9647 (83)
Total gains	603.5999	738.5979	906.2299	1101.9677	1241.4589	1241.5797	1179.7990	1059.6864	907.4213	724.7100	601.2306	564.0781 (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	37.1268	37.2163	37.3045	37.7242	37.8037	38.1786	38.1786	38.2489	38.0333	37.8037	37.6431	37.4766	
alpha	3.4751	3.4811	3.4870	3.5149	3.5202	3.5452	3.5452	3.5499	3.5356	3.5202	3.5095	3.4984	
util living area	0.9939	0.9873	0.9684	0.9134	0.8021	0.6418	0.4976	0.5633	0.8061	0.9567	0.9894	0.9952 (86)	
MIT	19.0511	19.2880	19.6999	20.2284	20.6495	20.8886	20.9659	20.9474	20.7380	20.1541	19.5039	19.0130 (87)	
Th 2	19.8945	19.8969	19.8992	19.9101	19.9121	19.9216	19.9216	19.9233	19.9179	19.9121	19.9080	19.9037 (88)	
util rest of house	0.9925	0.9842	0.9605	0.8917	0.7537	0.5584	0.3867	0.4494	0.7390	0.9417	0.9863	0.9941 (89)	
MIT 2	18.1164	18.3534	18.7618	19.2800	19.6635	19.8622	19.9100	19.9036	19.7552	19.2213	18.5778	18.0851 (90)	
Living area fraction									fLA = Living area / (4) =				0.1415 (91)
MIT	18.2486	18.4856	18.8945	19.4142	19.8030	20.0074	20.0594	20.0513	19.8942	19.3533	18.7089	18.2163 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.2486	18.4856	18.8945	19.4142	19.8030	20.0074	20.0594	20.0513	19.8942	19.3533	18.7089	18.2163 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9894	0.9789	0.9512	0.8798	0.7482	0.5655	0.4015	0.4638	0.7373	0.9316	0.9816	0.9915 (94)
Useful gains	597.1750	722.9809	862.0379	969.5205	928.8669	702.1445	473.7308	491.5248	669.0071	675.1224	590.1624	559.2816 (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												
	2016.3854	1959.1888	1783.1946	1495.8402	1150.3751	760.1482	486.3020	512.3429	817.6353	1242.7010	1655.1370	2007.2613 (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												
	1055.8926	830.7317	685.3405	378.9501	164.8021	0.0000	0.0000	0.0000	0.0000	422.2785	766.7817	1077.2969 (98)
Space heating												5382.0742 (98)
Space heating per m2												45.8673 (99)
										(98) / (4) =		

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5933.9297 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1055.8926	830.7317	685.3405	378.9501	164.8021	0.0000	0.0000	0.0000	0.0000	422.2785	766.7817	1077.2969	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1164.1594	915.9114	755.6125	417.8061	181.7003	0.0000	0.0000	0.0000	0.0000	465.5771	845.4043	1187.7585	(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	193.8655	170.3433	177.6405	157.4949	153.0616	134.9348	127.8558	142.6968	143.2024	163.3940	174.9702	188.6099	(64)
Efficiency of water heater (217)m	90.2540	90.2110	90.1091	89.8596	89.3298	87.9000	87.9000	87.9000	87.9000	89.9011	90.1664	87.9000	(216)
Fuel for water heating, kWh/month	214.7999	188.8276	197.1392	175.2677	171.3444	153.5095	145.4560	162.3400	162.9151	181.7487	194.0526	208.9361	(219)
Water heating fuel used												2156.3368	(219)
Annual totals kWh/year													
Space heating fuel - main system												5933.9297	(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)												443.5305	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.14 * 853 * 1.00) =										-777.9633		-777.9633	(233)
Total delivered energy for all uses												7830.8338	(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	5933.9297	0.2160	1281.7288 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2156.3368	0.2160	465.7688 (264)
Space and water heating			1747.4976 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.5305	0.5190	230.1923 (268)
Energy saving/generation technologies			
PV Unit	-777.9633	0.5190	-403.7629 (269)
Total CO2, kg/year			1612.8520 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7500 (273)

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

DER		13.7500	ZC1
Total Floor Area	TFA	117.3400	
Assumed number of occupants	N	2.8524	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2266	ZC2
CO2 emissions from cooking, equation (L16)		1.5976	ZC3
Total CO2 emissions		29.5741	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		29.5741	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6700 (1b)	x 2.3900 (2b)	= 140.2213 (1b) - (3b)
First floor	58.6700 (1c)	x 2.6800 (2c)	= 157.2356 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.4569 (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) = 0.1345 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3845 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3845 (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	0.4902	0.4806	0.4710	0.4229	0.4133	0.3652	0.3652	0.3556	0.3845	0.4133	0.4325	0.4518 (22b)
Effective ac	0.6201	0.6155	0.6109	0.5894	0.5854	0.5667	0.5667	0.5632	0.5739	0.5854	0.5935	0.6020 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			26.7000	1.3258	35.3977		(27)					
Ground Floor			58.6700	0.1300	7.6271		(28a)					
Brick and Block	170.1500	28.8200	141.3300	0.1800	25.4394		(29a)					
Pitched Roof	58.6700		58.6700	0.1300	7.6271		(30)					
Total net area of external elements Aum(A, m2)			287.4900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.2113		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2787 (36)					
Total fabric heat loss						(33) + (36) =	91.4900 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 60.8744	Feb 60.4164	Mar 59.9675	Apr 57.8590	May 57.4645	Jun 55.6281	Jul 55.6281	Aug 55.2880	Sep 56.3354	Oct 57.4645	Nov 58.2626	Dec 59.0969 (38)
Heat transfer coeff	152.3644	151.9064	151.4575	149.3490	148.9545	147.1181	147.1181	146.7780	147.8255	148.9545	149.7526	150.5869 (39)
Average = Sum(39)m / 12 =												149.3471 (39)
HLP	Jan 1.2985	Feb 1.2946	Mar 1.2908	Apr 1.2728	May 1.2694	Jun 1.2538	Jul 1.2538	Aug 1.2509	Sep 1.2598	Oct 1.2694	Nov 1.2762	Dec 1.2833 (40)
HLP (average)												1.2728 (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												2.8524 (42)
Average daily hot water use (litres/day)												101.9451 (43)
Daily hot water use	112.1396	108.0618	103.9840	99.9062	95.8284	91.7505	91.7505	95.8284	99.9062	103.9840	108.0618	112.1396 (44)
Energy conte	166.2997	145.4468	150.0881	130.8504	125.5541	108.3436	100.3963	115.2062	116.5822	135.8653	148.3076	161.0524 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9927 (45)
Distribution loss (46)m = 0.15 x (45)m	24.9450	21.8170	22.5132	19.6276	18.8331	16.2515	15.0594	17.2809	17.4873	20.3798	22.2461	24.1579 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi 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 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.2688	48.8331	45.2468	46.7551	48.8331	49.2688	50.9589	49.3151	50.9589 (61)
Solar input	217.2586	191.4742	201.0470	180.1192	174.3872	153.5905	147.1514	164.0393	165.8509	186.8242	197.6226	212.0113 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	217.2586	191.4742	201.0470	180.1192	174.3872	153.5905	147.1514	164.0393	165.8509	186.8242	197.6226	212.0113 (64)
	68.0344	59.8679	62.6440	55.8250	53.9550	47.3360	45.0705	50.5143	51.0808	57.9149	61.6410	66.2897 (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	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1145	22.3065	18.1409	13.7338	10.2662	8.6671	9.3652	12.1732	16.3388	20.7459	24.2135	25.8125	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7087	284.6319	277.2654	261.5830	241.7868	223.1811	210.7514	207.8281	215.1946	230.8770	250.6733	269.2789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	(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)	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	(71)
Water heating gains (Table 5)	91.4441	89.0892	84.1989	77.5347	72.5202	65.7444	60.5787	67.8956	70.9455	77.8426	85.6125	89.0990	(72)
Total internal gains	467.0536	464.8139	448.3916	421.6378	393.3595	366.3790	349.4815	356.6833	371.2653	398.2519	429.2857	452.9768	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d				Gains W
North					5.7600	10.6334	0.6300	0.7000	0.7700				18.7183 (74)
East					11.4800	19.6403	0.6300	0.7000	0.7700				68.9066 (76)
West					9.4600	19.6403	0.6300	0.7000	0.7700				56.7819 (80)
Solar gains	144.4069	281.6451	465.7034	688.1856	855.2653	881.6783	836.8012	710.1747	544.0201	334.3311	179.8103	118.9647	(83)
Total gains	611.4605	746.4591	914.0950	1109.8234	1248.6247	1248.0573	1186.2827	1066.8579	915.2854	732.5830	609.0960	571.9415	(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	53.4811	53.6423	53.8013	54.5609	54.7054	55.3882	55.3882	55.5166	55.1232	54.7054	54.4138	54.1123	
alpha	4.5654	4.5762	4.5868	4.6374	4.6470	4.6925	4.6925	4.7011	4.6749	4.6470	4.6276	4.6075	
util living area	0.9989	0.9970	0.9894	0.9570	0.8628	0.6926	0.5307	0.6037	0.8653	0.9835	0.9976	0.9992	(86)
MIT	19.4931	19.6731	19.9920	20.4168	20.7588	20.9394	20.9861	20.9755	20.8211	20.3509	19.8468	19.4697	(87)
Th 2	19.8420	19.8451	19.8481	19.8622	19.8649	19.8772	19.8772	19.8795	19.8725	19.8649	19.8595	19.8539	(88)
util rest of house	0.9985	0.9959	0.9855	0.9402	0.8119	0.5949	0.4029	0.4708	0.7937	0.9746	0.9966	0.9989	(89)
MIT 2	17.8360	18.1011	18.5670	19.1815	19.6326	19.8382	19.8724	19.8698	19.7267	19.1006	18.3655	17.8099	(90)
Living area fraction	18.0704	18.3235	18.7686	19.3562	19.7919	19.9940	20.0299	20.0262	19.8815	19.2775	18.5751	18.0447	(91)
MIT	18.0704	18.3235	18.7686	19.3562	19.7919	19.9940	20.0299	20.0262	19.8815	19.2775	18.5751	18.0447	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0704	18.3235	18.7686	19.3562	19.7919	19.9940	20.0299	20.0262	19.8815	19.2775	18.5751	18.0447	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	609.9024	741.6788	895.8100	1032.6889	1009.0034	756.1996	499.3127	521.9024	727.1258	708.9450	605.8495	570.8693	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2098.1198	2039.1128	1858.1670	1561.6256	1205.3314	793.5555	504.6051	532.2458	854.6550	1292.5552	1718.4187	2084.8352	(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	1107.2338	871.8757	715.9936	380.8344	146.0680	0.0000	0.0000	0.0000	0.0000	434.2060	801.0498	1126.3906	(98)
Space heating												5583.6519	(98)
Space heating per m2												47.5852	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5978.2140 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1107.2338	871.8757	715.9936	380.8344	146.0680	0.0000	0.0000	0.0000	0.0000	434.2060	801.0498	1126.3906	(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)	1185.4751	933.4857	766.5884	407.7456	156.3897	0.0000	0.0000	0.0000	0.0000	464.8886	857.6551	1205.9857	(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	217.2586	191.4742	201.0470	180.1192	174.3872	153.5905	147.1514	164.0393	165.8509	186.8242	197.6226	212.0113	(64)
Efficiency of water heater (217)m	88.5726	88.3979	87.9741	86.8908	84.6088	80.3000	80.3000	80.3000	80.3000	87.1042	88.2046	80.3000	(216)
Fuel for water heating, kWh/month	245.2888	216.6049	228.5297	207.2938	206.1100	191.2708	183.2520	204.2831	206.5392	214.4836	224.0502	239.1985	(219)
Water heating fuel used												2566.9046	(219)
Annual totals kWh/year													
Space heating fuel - main system												5978.2140	(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)												443.5305	(232)
Total delivered energy for all uses												9063.6491	(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	5978.2140	0.2160	1291.2942 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2566.9046	0.2160	554.4514 (264)
Space and water heating			1845.7456 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.5305	0.5190	230.1923 (268)
Total CO2, kg/m2/year			2114.8629 (272)
Emissions per m2 for space and water heating			15.7299 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9618 (272b)
Emissions per m2 for pumps and fans			0.3317 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7299 * 1.00) + 1.9618 + 0.3317, rounded to 2 d.p.			18.0200 (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	58.6700 (1b)	x 2.3900 (2b)	= 140.2213 (1b) - (3b)
First floor	58.6700 (1c)	x 2.6800 (2c)	= 157.2356 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.4569 (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) =					40.0000 / (5) = 0.1345 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3350 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3350 (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	0.4271	0.4187	0.4103	0.3685	0.3601	0.3182	0.3182	0.3099	0.3350	0.3601	0.3768	0.3936 (22b)
Effective ac	0.5912	0.5877	0.5842	0.5679	0.5648	0.5506	0.5506	0.5480	0.5561	0.5648	0.5710	0.5775 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			26.7000	1.1450	30.5725		(27)
Ground Floor			58.6700	0.1200	7.0404	84.0000	4928.2800 (28a)
Brick and Block	170.1500	28.8200	141.3300	0.2400	33.9192	42.2200	5966.9526 (29a)
Pitched Roof	58.6700		58.6700	0.1000	5.8670	9.1000	533.8970 (30)
Total net area of external elements Aum(A, m ²)			287.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7311		(33)
GF Block			57.8100			75.0000	4335.7500 (32c)
GF Stud			34.4900			9.0000	310.4100 (32c)
FF Stud			125.9700			9.0000	1133.7300 (32c)
Internal Floor 1			58.6700			18.0000	1056.0600 (32d)
Internal Ceiling 1			58.6700			9.0000	528.0300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18793.1096 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							160.1594 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7939 (36)
Total fabric heat loss						(33) + (36) =	86.5250 (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	58.0330	57.6853	57.3446	55.7441	55.4446	54.0506	54.0506	53.7925	54.5876	55.4446	56.0504	56.6837 (38)
Heat transfer coeff	144.5580	144.2104	143.8696	142.2691	141.9696	140.5756	140.5756	140.3175	141.1126	141.9696	142.5754	143.2088 (39)
Average = Sum(39)m / 12 =												142.2677 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2320	1.2290	1.2261	1.2125	1.2099	1.1980	1.1980	1.1958	1.2026	1.2099	1.2151	1.2205 (40)
HLP (average)												1.2124 (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												2.8524 (42)
Average daily hot water use (litres/day)												101.9451 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1396	108.0618	103.9840	99.9062	95.8284	91.7505	91.7505	95.8284	99.9062	103.9840	108.0618	112.1396 (44)
Energy conte	166.2997	145.4468	150.0881	130.8504	125.5541	108.3436	100.3963	115.2062	116.5822	135.8653	148.3076	161.0524 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9927 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.3387	30.9074	31.8937	27.8057	26.6802	23.0230	21.3342	24.4813	24.7737	28.8714	31.5154	34.2236 (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	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1145	22.3065	19.1409	13.7338	10.2662	8.6671	9.3652	12.1732	16.3388	20.7459	24.2135	25.8125	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7087	284.6319	277.2654	261.5830	241.7868	223.1811	210.7514	207.8281	215.1946	230.8770	250.6733	269.2789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	(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)	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	(71)
Water heating gains (Table 5)	47.4982	45.9932	42.8679	38.6190	35.8605	31.9764	28.6750	32.9050	34.4079	38.8056	43.7713	45.9995	(72)
Total internal gains	420.1078	418.7180	404.0605	379.7222	353.6998	329.6110	314.5779	318.6926	331.7277	356.2149	384.4445	406.8774	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North					5.7600	10.6334	0.6300	0.7000	0.7700	18.7183 (74)			
East					11.4800	19.6403	0.6300	0.7000	0.7700	68.9066 (76)			
West					9.4600	19.6403	0.6300	0.7000	0.7700	56.7819 (80)			

Solar gains	144.4069	281.6451	465.7034	688.1856	855.2653	881.6783	836.8012	710.1747	544.0201	334.3311	179.8103	118.9647	(83)
Total gains	564.5147	700.3631	869.7639	1067.9078	1208.9651	1211.2893	1151.3790	1028.8673	875.7478	690.5459	564.2548	525.8420	(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	36.1122	36.1993	36.2850	36.6932	36.7706	37.1352	37.1352	37.2035	36.9939	36.7706	36.6144	36.4524	
alpha	3.4075	3.4133	3.4190	3.4462	3.4514	3.4757	3.4757	3.4802	3.4663	3.4514	3.4410	3.4302	
util living area	0.9946	0.9883	0.9701	0.9168	0.8082	0.6504	0.5066	0.5747	0.8153	0.9600	0.9905	0.9958	(86)
MIT	18.9711	19.2140	19.6374	20.1830	20.6220	20.8764	20.9611	20.9401	20.7135	20.1041	19.4351	18.9327	(87)
Th 2	19.8945	19.8969	19.8992	19.9101	19.9121	19.9216	19.9216	19.9233	19.9179	19.9121	19.9080	19.9037	(88)
util rest of house	0.9933	0.9855	0.9628	0.8961	0.7611	0.5676	0.3949	0.4603	0.7504	0.9462	0.9878	0.9947	(89)
MIT 2	18.0398	18.2831	18.7033	19.2393	19.6415	19.8547	19.9080	19.9003	19.7372	19.1758	18.5126	18.0082	(90)
Living area fraction									fLA = Living area / (4) =			0.1415	(91)
MIT	18.1715	18.4148	18.8355	19.3728	19.7802	19.9992	20.0570	20.0474	19.8753	19.3071	18.6431	18.1390	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1715	18.4148	18.8355	19.3728	19.7802	19.9992	20.0570	20.0474	19.8753	19.3071	18.6431	18.1390	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9904	0.9803	0.9535	0.8836	0.7546	0.5740	0.4096	0.4744	0.7474	0.9361	0.9833	0.9924	(94)
Ext temp.	559.0955	686.5729	829.3119	943.6460	912.2617	695.3130	471.6597	488.1224	654.5398	646.3867	554.8528	521.8425	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2005.2420	1948.9699	1774.7029	1489.9611	1147.1410	758.9973	485.9720	511.7988	814.9705	1236.1491	1645.7682	1996.1858	(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	1075.9330	848.3307	703.3709	393.3469	174.7502	0.0000	0.0000	0.0000	0.0000	438.7832	785.4591	1096.9114	(98)
Space heating per m2												5516.8854	(98)
										(98) / (4) =		47.0162	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1321.4111	1040.2598	1066.4130	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8296	0.8861	0.8504	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1096.2049	921.7260	906.8939	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1529.2989	1456.7369	1315.6189	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	311.8277	398.0481	304.0914	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1013.9672 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	77.9569	99.5120	76.0228	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												253.4918 (107)
Space cooling per m2												2.1603 (108)
Energy for space heating												47.0162 (99)
Energy for space cooling												2.1603 (108)
Total												49.1766 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.2 (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	58.6700 (1b)	x 2.3900 (2b)	= 140.2213 (1b) - (3b)
First floor	58.6700 (1c)	x 2.6800 (2c)	= 157.2356 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.4569 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =							0.1345 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3845 (18)
Number of sides sheltered																	0 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							1.0000 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3845 (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)				
Adj infilt rate	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)				
	0.4902	0.4806	0.4710	0.4229	0.4133	0.3652	0.3652	0.3556	0.3845	0.4133	0.4325	0.4518	(22b)				
Effective ac	0.6201	0.6155	0.6109	0.5894	0.5854	0.5667	0.5667	0.5632	0.5739	0.5854	0.5935	0.6020	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			26.7000	1.3258	35.3977		(27)					
Ground Floor			58.6700	0.1300	7.6271		(28a)					
Brick and Block	170.1500	28.8200	141.3300	0.1800	25.4394		(29a)					
Pitched Roof	58.6700		58.6700	0.1300	7.6271		(30)					
Total net area of external elements Aum(A, m2)			287.4900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		78.2113		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2787 (36)					
Total fabric heat loss						(33) + (36) =	91.4900 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 60.8744	Feb 60.4164	Mar 59.9675	Apr 57.8590	May 57.4645	Jun 55.6281	Jul 55.6281	Aug 55.2880	Sep 56.3354	Oct 57.4645	Nov 58.2626	Dec 59.0969 (38)
Heat transfer coeff	152.3644	151.9064	151.4575	149.3490	148.9545	147.1181	147.1181	146.7780	147.8255	148.9545	149.7526	150.5869 (39)
Average = Sum(39)m / 12 =												149.3471 (39)
HLP	Jan 1.2985	Feb 1.2946	Mar 1.2908	Apr 1.2728	May 1.2694	Jun 1.2538	Jul 1.2538	Aug 1.2509	Sep 1.2598	Oct 1.2694	Nov 1.2762	Dec 1.2833 (40)
HLP (average)												1.2728 (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												2.8524 (42)
Average daily hot water use (litres/day)												101.9451 (43)
Daily hot water use	Jan 112.1396	Feb 108.0618	Mar 103.9840	Apr 99.9062	May 95.8284	Jun 91.7505	Jul 91.7505	Aug 95.8284	Sep 99.9062	Oct 103.9840	Nov 108.0618	Dec 112.1396 (44)
Energy conte	166.2997	145.4468	150.0881	130.8504	125.5541	108.3436	100.3963	115.2062	116.5822	135.8653	148.3076	161.0524 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9927 (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	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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	35.3387	30.9074	31.8937	27.8057	26.6802	23.0230	21.3342	24.4813	24.7737	28.8714	31.5154	34.2236 (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	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212	142.6212 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1145	22.3065	18.1409	13.7338	10.2662	8.6671	9.3652	12.1732	16.3388	20.7459	24.2135	25.8125 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7087	284.6319	277.2654	261.5830	241.7868	223.1811	210.7514	207.8281	215.1946	230.8770	250.6733	269.2789 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621	37.2621 (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)	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969 (71)
Water heating gains (Table 5)	47.4982	45.9932	42.8679	38.6190	35.8605	31.9764	28.6750	32.9050	34.4079	38.8056	43.7713	45.9995 (72)
Total internal gains	420.1078	418.7180	404.0605	379.7222	353.6998	329.6110	314.5779	318.6926	331.7277	356.2149	384.4445	406.8774 (73)

6. Solar gains												

[Jan]												
	Area											
	m2											
	Solar flux											
	Table 6a											
	W/m2											
	Specific data											
	or Table 6b											
	Specific data											
	or Table 6c											
	Access											
	factor											
	Table 6d											
	Gains											
	W											
North	5.7600											18.7183 (74)
East	11.4800											68.9066 (76)
West	9.4600											56.7819 (80)

Solar gains	144.4069	281.6451	465.7034	688.1856	855.2653	881.6783	836.8012	710.1747	544.0201	334.3311	179.8103	118.9647 (83)
Total gains	564.5147	700.3631	869.7639	1067.9078	1208.9651	1211.2893	1151.3790	1028.8673	875.7478	690.5459	564.2548	525.8420 (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	53.4811	53.6423	53.8013	54.5609	54.7054	55.3882	55.3882	55.5166	55.1232	54.7054	54.4138	54.1123
alpha	4.5654	4.5762	4.5868	4.6374	4.6470	4.6925	4.6925	4.7011	4.6749	4.6470	4.6276	4.6075
util living area	0.9992	0.9977	0.9913	0.9624	0.8740	0.7076	0.5451	0.6220	0.8803	0.9869	0.9983	0.9994 (86)
MIT	19.4567	19.6376	19.9591	20.3898	20.7425	20.9337	20.9845	20.9723	20.8045	20.3204	19.8121	19.4338 (87)
Th 2	19.8420	19.8451	19.8481	19.8622	19.8649	19.8772	19.8772	19.8795	19.8725	19.8649	19.8595	19.8539 (88)
util rest of house	0.9989	0.9968	0.9880	0.9473	0.8254	0.6099	0.4146	0.4869	0.8129	0.9796	0.9975	0.9992 (89)
MIT 2	18.4360	18.6191	18.9410	19.3725	19.6938	19.8477	19.8735	19.8719	19.7615	19.3137	18.8049	18.4225 (90)
Living area fraction									fLA = Living area / (4) =			0.1415 (91)
MIT	18.5804	18.7632	19.0850	19.5164	19.8422	20.0013	20.0307	20.0275	19.9091	19.4561	18.9474	18.5656 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5804	18.7632	19.0850	19.5164	19.8422	20.0013	20.0307	20.0275	19.9091	19.4561	18.9474	18.5656 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9984	0.9957	0.9849	0.9415	0.8242	0.6217	0.4332	0.5059	0.8156	0.9758	0.9966	0.9989 (94)
Useful gains	563.6308	697.3241	856.6630	1005.4052	996.4540	753.0548	498.7456	520.5549	714.2640	673.8597	562.3334	525.2533 (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	2175.8292	2105.9053	1906.0992	1585.5520	1212.8132	794.6361	504.7124	532.4433	858.7272	1319.1586	1774.1779	2163.2690 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1199.4756	946.5666	780.7806	417.7057	160.9713	0.0000	0.0000	0.0000	0.0000	480.1023	872.5280	1218.6836 (98)
Space heating												6076.8137 (98)
Space heating per m2										(98) / (4) =		51.7881 (99)

8c. Space cooling requirement												

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1382.9101	1088.6739	1115.5129	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8631	0.9204	0.8851	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1193.5793	1002.0347	987.3733	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1529.2989	1456.7369	1315.6189	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	241.7181	338.2985	244.2147	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												824.2313 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

09 Jan 2014

Cooled fraction	FC = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	60.4295	84.5746	61.0537	0.0000	0.0000	0.0000 (107)
Space cooling											206.0578 (107)
Space cooling per m2											1.7561 (108)
Energy for space heating											51.7881 (99)
Energy for space cooling											1.7561 (108)
Total											53.5442 (109)
Target Fabric Energy Efficiency (TFEE)											61.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6700 (1b)	x 2.3900 (2b)	= 140.2213 (1b) - (3b)
First floor	58.6700 (1c)	x 2.6800 (2c)	= 157.2356 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.4569 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour				
										heating	heating							
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans																4 * 10 =	40.0000 (7a)	
Number of passive vents																0 * 10 =	0.0000 (7b)	
Number of flueless gas fires																0 * 40 =	0.0000 (7c)	
										Air changes per hour								
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =							40.0000 / (5) =	0.1345 (8)
Pressure test																	Yes	
Measured/design AP50																		4.0100
Infiltration rate																		0.3350 (18)
Number of sides sheltered																		0 (19)
Shelter factor																	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor																	(21) = (18) x (20) =	0.3350 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)						
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)						
Adj infilt rate	0.3936	0.3685	0.3685	0.3350	0.3433	0.3266	0.3266	0.3182	0.3182	0.3433	0.3350	0.3433 (22b)						
Effective ac	0.5775	0.5679	0.5679	0.5561	0.5589	0.5533	0.5533	0.5506	0.5506	0.5589	0.5561	0.5589 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			26.7000	1.1450	30.5725		(27)
Ground Floor			58.6700	0.1200	7.0404	84.0000	4928.2800 (28a)
Brick and Block	170.1500	28.8200	141.3300	0.2400	33.9192	42.2200	5966.9526 (29a)
Pitched Roof	58.6700		58.6700	0.1000	5.8670	9.1000	533.8970 (30)
Total net area of external elements Aum(A, m ²)			287.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7311		(33)
GF Block			57.8100			75.0000	4335.7500 (32c)
GF Stud			34.4900			9.0000	310.4100 (32c)
FF Stud			125.9700			9.0000	1133.7300 (32c)
Internal Floor 1			58.6700			18.0000	1056.0600 (32d)
Internal Ceiling 1			58.6700			18.0000	1056.0600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19321.1396 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 164.6594 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7939 (36)
Total fabric heat loss (33) + (36) = 86.5250 (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	56.6837	55.7441	55.7441	54.5876	54.8664	54.3156	54.3156	54.0506	54.0506	54.8664	54.5876	54.8664 (38)
Heat transfer coeff	143.2088	142.2691	142.2691	141.1126	141.3914	140.8407	140.8407	140.5756	140.5756	141.3914	141.1126	141.3914 (39)
Average = Sum(39)m / 12 =												141.4149 (39)
HLP	1.2205	1.2125	1.2125	1.2026	1.2050	1.2003	1.2003	1.1980	1.1980	1.2050	1.2026	1.2050 (40)
HLP (average)												1.2052 (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												2.8524 (42)
Average daily hot water use (litres/day)												101.9451 (43)
Daily hot water use	112.1396	108.0618	103.9840	99.9062	95.8284	91.7505	91.7505	95.8284	99.9062	103.9840	108.0618	112.1396 (44)
Energy conte	166.2997	145.4468	150.0881	130.8504	125.5541	108.3436	100.3963	115.2062	116.5822	135.8653	148.3076	161.0524 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9927 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9450	21.8170	22.5132	19.6276	18.8331	16.2515	15.0594	17.2809	17.4873	20.3798	22.2461	24.1579 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8655	170.3433	177.6405	157.4949	153.0616	134.9348	127.8558	142.6968	143.2024	163.3940	174.9702	188.6099 (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	193.8655	170.3433	177.6405	157.4949	153.0616	134.9348	127.8558	142.6968	143.2024	163.3940	174.9702	188.6099 (64)
RHI water heating demand												1928.0698 (64)
Heat gains from water heating, kWh/month	62.1861	54.5852	56.7924	50.1689	48.6236	42.6721	40.2467	45.1787	45.4186	52.0574	55.9779	60.4393 (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	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7863	55.7663	45.3522	34.3345	25.6655	21.6679	23.4129	30.4330	40.8470	51.8647	60.5338	64.5314 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.4607	424.8238	413.8290	390.4224	360.8758	333.1061	314.5543	310.1912	321.1860	344.5926	374.1392	401.9089 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670 (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)	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969 (71)
Water heating gains (Table 5)	83.5835	81.2280	76.3339	69.6790	65.3543	59.2667	54.0950	60.7241	63.0814	69.9696	77.7471	81.2356 (72)
Total internal gains	681.8460	676.8335	650.5305	609.4513	566.9110	529.0561	507.0775	516.3637	540.1299	581.4423	627.4355	662.6913 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				5.7600	13.4684	0.6300	0.7000	0.7700	23.7089 (74)			
East				11.4800	25.1733	0.6300	0.7000	0.7700	88.3188 (76)			
West				9.4600	25.1733	0.6300	0.7000	0.7700	72.7784 (80)			
Solar gains	184.8060	307.1108	516.4537	763.3420	889.5085	1012.9778	924.3814	820.9785	630.7583	393.3655	229.4677	144.0415 (83)
Total gains	866.6520	983.9442	1166.9841	1372.7933	1456.4195	1542.0340	1431.4590	1337.3422	1170.8881	974.8078	856.9032	806.7328 (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	37.4766	37.7242	37.7242	38.0333	37.9583	38.1068	38.1068	38.1786	38.1786	37.9583	38.0333	37.9583
alpha	3.4984	3.5149	3.5149	3.5356	3.5306	3.5405	3.5405	3.5452	3.5452	3.5306	3.5356	3.5306
util living area	0.9765	0.9634	0.9224	0.8216	0.6668	0.4486	0.3206	0.3316	0.6078	0.8666	0.9574	0.9805 (86)
MIT	19.5359	19.7198	20.1042	20.5561	20.8423	20.9713	20.9936	20.9932	20.9181	20.5527	19.9944	19.5161 (87)
Th 2	19.9037	19.9101	19.9101	19.9179	19.9160	19.9198	19.9198	19.9216	19.9216	19.9160	19.9179	19.9160 (88)
util rest of house	0.9709	0.9550	0.9047	0.7831	0.6001	0.3604	0.2176	0.2222	0.5125	0.8254	0.9455	0.9758 (89)
MIT 2	18.6035	18.7882	19.1592	19.5820	19.8190	19.9085	19.9186	19.9204	19.8831	19.5910	19.0665	18.5937 (90)
Living area fraction									fLA = Living area / (4) =			0.1415 (91)
MIT	18.7354	18.9200	19.2929	19.7198	19.9638	20.0588	20.0707	20.0721	20.0295	19.7271	19.1978	18.7242 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7354	18.9200	19.2929	19.7198	19.9638	20.0588	20.0707	20.0721	20.0295	19.7271	19.1978	18.7242 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9630	0.9451	0.8924	0.7751	0.6033	0.3721	0.2322	0.2377	0.5227	0.8168	0.9352	0.9688 (94)
Ext temp.	834.6110	929.8903	1041.4739	1064.0893	878.6429	573.7891	332.4032	317.8858	612.0807	796.2655	801.3757	781.5360 (95)
Heat loss rate W	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Month fracti	1881.1016	1838.1156	1663.5381	1357.4798	970.4819	585.7348	333.8844	319.4052	650.7988	1078.4029	1495.4768	1841.5063 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating	778.5890	610.3274	462.8157	211.2412	68.3282	0.0000	0.0000	0.0000	0.0000	209.9103	499.7528	788.6179 (98)
RHI space heating demand												3629.5825 (98)
												3630 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6700 (1b)	x 2.3900 (2b)	= 140.2213 (1b) - (3b)
First floor	58.6700 (1c)	x 2.6800 (2c)	= 157.2356 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.4569 (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) = 0.1345 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3350 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3350 (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	0.4271	0.4187	0.4103	0.3685	0.3601	0.3182	0.3182	0.3099	0.3350	0.3601	0.3768	0.3936 (22b)
Effective ac	0.5912	0.5877	0.5842	0.5679	0.5648	0.5506	0.5506	0.5480	0.5561	0.5648	0.5710	0.5775 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			26.7000	1.1450	30.5725		(27)
Ground Floor			58.6700	0.1200	7.0404	84.0000	4928.2800 (28a)
Brick and Block	170.1500	28.8200	141.3300	0.2400	33.9192	42.2200	5966.9526 (29a)
Pitched Roof	58.6700		58.6700	0.1000	5.8670	9.1000	533.8970 (30)
Total net area of external elements Aum(A, m ²)			287.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7311		(33)
GF Block			57.8100			75.0000	4335.7500 (32c)
GF Stud			34.4900			9.0000	310.4100 (32c)
FF Stud			125.9700			9.0000	1133.7300 (32c)
Internal Floor 1			58.6700			18.0000	1056.0600 (32d)
Internal Ceiling 1			58.6700			18.0000	1056.0600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19321.1396 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 164.6594 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7939 (36)
Total fabric heat loss (33) + (36) = 86.5250 (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	58.0330	57.6853	57.3446	55.7441	55.4446	54.0506	54.0506	53.7925	54.5876	55.4446	56.0504	56.6837 (38)
Heat transfer coeff	144.5580	144.2104	143.8696	142.2691	141.9696	140.5756	140.5756	140.3175	141.1126	141.9696	142.5754	143.2088 (39)
Average = Sum(39)m / 12 =												142.2677 (39)
HLP	1.2320	1.2290	1.2261	1.2125	1.2099	1.1980	1.1980	1.1958	1.2026	1.2099	1.2151	1.2205 (40)
HLP (average)												1.2124 (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												2.8524 (42)
Average daily hot water use (litres/day)												101.9451 (43)
Daily hot water use	112.1396	108.0618	103.9840	99.9062	95.8284	91.7505	91.7505	95.8284	99.9062	103.9840	108.0618	112.1396 (44)
Energy conte	166.2997	145.4468	150.0881	130.8504	125.5541	108.3436	100.3963	115.2062	116.5822	135.8653	148.3076	161.0524 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9927 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9450	21.8170	22.5132	19.6276	18.8331	16.2515	15.0594	17.2809	17.4873	20.3798	22.2461	24.1579 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8655	170.3433	177.6405	157.4949	153.0616	134.9348	127.8558	142.6968	143.2024	163.3940	174.9702	188.6099 (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	193.8655	170.3433	177.6405	157.4949	153.0616	134.9348	127.8558	142.6968	143.2024	163.3940	174.9702	188.6099 (64)
Heat gains from water heating, kWh/month	62.1861	54.5852	56.7924	50.1689	48.6236	42.6721	40.2467	45.1787	45.4186	52.0574	55.9779	60.4393 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1928.0698 (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	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7863	55.7663	45.3522	34.3345	25.6655	21.6679	23.4129	30.4330	40.8470	51.8647	60.5338	64.5314 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.4607	424.8238	413.8290	390.4224	360.8758	333.1061	314.5543	310.1912	321.1860	344.5926	374.1392	401.9089 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670 (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)	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969 (71)
Water heating gains (Table 5)	83.5835	81.2280	76.3339	69.6790	65.3543	59.2667	54.0950	60.7241	63.0814	69.9696	77.7471	81.2356 (72)
Total internal gains	681.8460	676.8335	650.5305	609.4513	566.9110	529.0561	507.0775	516.3637	540.1299	581.4423	627.4355	662.6913 (73)

6. Solar gains

[Jan]													
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				5.7600	10.6334		0.6300		0.7000		0.7700		18.7183 (74)
East				11.4800	19.6403		0.6300		0.7000		0.7700		68.9066 (76)
West				9.4600	19.6403		0.6300		0.7000		0.7700		56.7819 (80)
Solar gains	144.4069	281.6451	465.7034	688.1856	855.2653	881.6783	836.8012	710.1747	544.0201	334.3311	179.8103	118.9647	(83)
Total gains	826.2528	958.4786	1116.2338	1297.6369	1422.1762	1410.7345	1343.8787	1226.5383	1084.1500	915.7734	807.2458	781.6559	(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	37.1268	37.2163	37.3045	37.7242	37.8037	38.1786	38.1786	38.2489	38.0333	37.8037	37.6431	37.4766
alpha	3.4751	3.4811	3.4870	3.5149	3.5202	3.5452	3.5452	3.5499	3.5356	3.5202	3.5095	3.4984
util living area	0.9840	0.9725	0.9441	0.8735	0.7490	0.5839	0.4439	0.4993	0.7359	0.9201	0.9742	0.9867 (86)
MIT	19.2801	19.5061	19.8895	20.3654	20.7244	20.9177	20.9762	20.9641	20.8097	20.3154	19.7106	19.2391 (87)
Th 2	19.8945	19.8969	19.8992	19.9101	19.9121	19.9216	19.9216	19.9233	19.9179	19.9121	19.9080	19.9037 (88)
util rest of house	0.9804	0.9664	0.9315	0.8454	0.6959	0.5024	0.3421	0.3934	0.6613	0.8958	0.9674	0.9837 (89)
MIT 2	18.3431	18.5677	18.9439	19.4034	19.7219	19.8790	19.9137	19.9104	19.8053	19.3702	18.7805	18.3093 (90)
Living area fraction									fLA = Living area / (4) =			0.1415 (91)
MIT	18.4756	18.7004	19.0777	19.5395	19.8637	20.0260	20.0640	20.0595	19.9474	19.5039	18.9121	18.4409 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4756	18.7004	19.0777	19.5395	19.8637	20.0260	20.0640	20.0595	19.9474	19.5039	18.9121	18.4409 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	804.8919	917.8877	1026.6394	1082.5158	986.0645	720.5805	478.3819	499.6584	719.3994	810.0077	774.2245	764.5994 (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	2049.2011	1990.1624	1809.5436	1513.6669	1158.9989	762.7606	486.9606	513.4915	825.1464	1264.0905	1684.1166	2039.4145 (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	925.7660	720.5687	582.4807	310.4288	128.6632	0.0000	0.0000	0.0000	0.0000	337.8376	655.1223	948.4625 (98)
Space heating												4609.3298 (98)
Space heating per m2												39.2818 (99)
(98) / (4) =												

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5081.9512 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	925.7660	720.5687	582.4807	310.4288	128.6632	0.0000	0.0000	0.0000	0.0000	337.8376	655.1223	948.4625	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1020.6902	794.4528	642.2058	342.2589	141.8558	0.0000	0.0000	0.0000	0.0000	372.4780	722.2958	1045.7139	(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	193.8655	170.3433	177.6405	157.4949	153.0616	134.9348	127.8558	142.6968	143.2024	163.3940	174.9702	188.6099	(64)
Efficiency of water heater (217)m	90.2025	90.1509	90.0298	89.7379	89.1570	87.9000	87.9000	87.9000	87.9000	89.7678	90.0951	87.9000	(216)
Fuel for water heating, kWh/month	214.9226	188.9535	197.3130	175.5055	171.6764	153.5095	145.4560	162.3400	162.9151	182.0184	194.2062	209.0479	(219)
Water heating fuel used												2157.8642	(219)
Annual totals kWh/year													
Space heating fuel - main system												5081.9512	(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)												443.5305	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.14 * 853 * 1.00) =										-777.9633		-777.9633	(233)
Total delivered energy for all uses												6980.3827	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5081.9512	3.4800	176.8519 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2157.8642	3.4800	75.0937 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	443.5305	13.1900	58.5017 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-777.9633	13.1900	-102.6134 (252)
Total energy cost			337.7264 (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] =	0.8738 (257)
SAP value		87.8111
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	5081.9512	0.2160	1097.7015 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2157.8642	0.2160	466.0987 (264)
Space and water heating			1563.8001 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.5305	0.5190	230.1923 (268)
Energy saving/generation technologies			
PV Unit	-777.9633	0.5190	-403.7629 (269)
Total kg/year			1429.1545 (272)
CO2 emissions per m2			12.1800 (273)
EI value			88.2034
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8925 = 3.899$, stars = 4
Water heating environmental impact	$0.216 / 0.8925 = 0.2420$, 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	58.6700 (1b)	x 2.3900 (2b)	= 140.2213 (1b) - (3b)
First floor	58.6700 (1c)	x 2.6800 (2c)	= 157.2356 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.4569 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour				
										heating	heating							
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans																4 * 10 =	40.0000 (7a)	
Number of passive vents																0 * 10 =	0.0000 (7b)	
Number of flueless gas fires																0 * 40 =	0.0000 (7c)	
										Air changes per hour								
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =							40.0000 / (5) =	0.1345 (8)
Pressure test																	Yes	
Measured/design AP50																		4.0100
Infiltration rate																		0.3350 (18)
Number of sides sheltered																		0 (19)
Shelter factor																	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor																	(21) = (18) x (20) =	0.3350 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)						
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)						
Adj infilt rate	0.3936	0.3685	0.3685	0.3350	0.3433	0.3266	0.3266	0.3182	0.3182	0.3433	0.3350	0.3433 (22b)						
Effective ac	0.5775	0.5679	0.5679	0.5561	0.5589	0.5533	0.5533	0.5506	0.5506	0.5589	0.5561	0.5589 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			26.7000	1.1450	30.5725		(27)
Ground Floor			58.6700	0.1200	7.0404	84.0000	4928.2800 (28a)
Brick and Block	170.1500	28.8200	141.3300	0.2400	33.9192	42.2200	5966.9526 (29a)
Pitched Roof	58.6700		58.6700	0.1000	5.8670	9.1000	533.8970 (30)
Total net area of external elements Aum(A, m ²)			287.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7311		(33)
GF Block			57.8100			75.0000	4335.7500 (32c)
GF Stud			34.4900			9.0000	310.4100 (32c)
FF Stud			125.9700			9.0000	1133.7300 (32c)
Internal Floor 1			58.6700			18.0000	1056.0600 (32d)
Internal Ceiling 1			58.6700			18.0000	1056.0600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19321.1396 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 164.6594 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7939 (36)
Total fabric heat loss (33) + (36) = 86.5250 (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	56.6837	55.7441	55.7441	54.5876	54.8664	54.3156	54.3156	54.0506	54.0506	54.8664	54.5876	54.8664 (38)
Heat transfer coeff	143.2088	142.2691	142.2691	141.1126	141.3914	140.8407	140.8407	140.5756	140.5756	141.3914	141.1126	141.3914 (39)
Average = Sum(39)m / 12 =												141.4149 (39)
HLP	1.2205	1.2125	1.2125	1.2026	1.2050	1.2003	1.2003	1.1980	1.1980	1.2050	1.2026	1.2050 (40)
HLP (average)												1.2052 (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												2.8524 (42)
Average daily hot water use (litres/day)												101.9451 (43)
Daily hot water use	Jan 112.1396	Feb 108.0618	Mar 103.9840	Apr 99.9062	May 95.8284	Jun 91.7505	Jul 91.7505	Aug 95.8284	Sep 99.9062	Oct 103.9840	Nov 108.0618	Dec 112.1396 (44)
Energy conte	166.2997	145.4468	150.0881	130.8504	125.5541	108.3436	100.3963	115.2062	116.5822	135.8653	148.3076	161.0524 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9927 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	24.9450	21.8170	22.5132	19.6276	18.8331	16.2515	15.0594	17.2809	17.4873	20.3798	22.2461	24.1579 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8655	170.3433	177.6405	157.4949	153.0616	134.9348	127.8558	142.6968	143.2024	163.3940	174.9702	188.6099 (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	193.8655	170.3433	177.6405	157.4949	153.0616	134.9348	127.8558	142.6968	143.2024	163.3940	174.9702	188.6099 (64)
Heat gains from water heating, kWh/month	62.1861	54.5852	56.7924	50.1689	48.6236	42.6721	40.2467	45.1787	45.4186	52.0574	55.9779	60.4393 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1928.0698 (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	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7863	55.7663	45.3522	34.3345	25.6655	21.6679	23.4129	30.4330	40.8470	51.8647	60.5338	64.5314 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.4607	424.8238	413.8290	390.4224	360.8758	333.1061	314.5543	310.1912	321.1860	344.5926	374.1392	401.9089 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670 (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)	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969 (71)
Water heating gains (Table 5)	83.5835	81.2280	76.3339	69.6790	65.3543	59.2667	54.0950	60.7241	63.0814	69.9696	77.7471	81.2356 (72)
Total internal gains	681.8460	676.8335	650.5305	609.4513	566.9110	529.0561	507.0775	516.3637	540.1299	581.4423	627.4355	662.6913 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				5.7600	13.4684		0.6300		0.7000		0.7700		23.7089 (74)
East				11.4800	25.1733		0.6300		0.7000		0.7700		88.3188 (76)
West				9.4600	25.1733		0.6300		0.7000		0.7700		72.7784 (80)
Solar gains	184.8060	307.1108	516.4537	763.3420	889.5085	1012.9778	924.3814	820.9785	630.7583	393.3655	229.4677	144.0415	(83)
Total gains	866.6520	983.9442	1166.9841	1372.7933	1456.4195	1542.0340	1431.4590	1337.3422	1170.8881	974.8078	856.9032	806.7328	(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	37.4766	37.7242	37.7242	38.0333	37.9583	38.1068	38.1068	38.1786	38.1786	37.9583	38.0333	37.9583
alpha	3.4984	3.5149	3.5149	3.5356	3.5306	3.5405	3.5405	3.5452	3.5452	3.5306	3.5356	3.5306
util living area	0.9765	0.9634	0.9224	0.8216	0.6668	0.4486	0.3206	0.3316	0.6078	0.8666	0.9574	0.9805 (86)
MIT	19.5359	19.7198	20.1042	20.5561	20.8423	20.9713	20.9936	20.9932	20.9181	20.5527	19.9944	19.5161 (87)
Th 2	19.9037	19.9101	19.9101	19.9179	19.9160	19.9198	19.9198	19.9216	19.9216	19.9160	19.9179	19.9160 (88)
util rest of house	0.9709	0.9550	0.9047	0.7831	0.6001	0.3604	0.2176	0.2222	0.5125	0.8254	0.9455	0.9758 (89)
MIT 2	18.6035	18.7882	19.1592	19.5820	19.8190	19.9085	19.9186	19.9204	19.8831	19.5910	19.0665	18.5937 (90)
Living area fraction	18.7354	18.9200	19.2929	19.7198	19.9638	20.0588	20.0707	20.0721	20.0295	19.7271	19.1978	18.7242 (92)
MIT	18.7354	18.9200	19.2929	19.7198	19.9638	20.0588	20.0707	20.0721	20.0295	19.7271	19.1978	18.7242 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7354	18.9200	19.2929	19.7198	19.9638	20.0588	20.0707	20.0721	20.0295	19.7271	19.1978	18.7242 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	834.6110	929.8903	1041.4739	1064.0893	878.6429	573.7891	332.4032	317.8858	612.0807	796.2655	801.3757	781.5360 (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	1881.1016	1838.1156	1663.5381	1357.4798	970.4819	585.7348	333.8844	319.4052	650.7988	1078.4029	1495.4768	1841.5063 (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	778.5890	610.3274	462.8157	211.2412	68.3282	0.0000	0.0000	0.0000	0.0000	209.9103	499.7528	788.6179 (98)
Space heating												3629.5825 (98)
Space heating per m2												(98) / (4) = 30.9322 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.7000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4001.7448	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	778.5890	610.3274	462.8157	211.2412	68.3282	0.0000	0.0000	0.0000	0.0000	209.9103	499.7528	788.6179	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	858.4223	672.9078	510.2709	232.9010	75.3343	0.0000	0.0000	0.0000	0.0000	231.4336	550.9954	869.4795	(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	193.8655	170.3433	177.6405	157.4949	153.0616	134.9348	127.8558	142.6968	143.2024	163.3940	174.9702	188.6099	(64)
Efficiency of water heater (217)m	90.1277	90.0739	89.9057	89.4825	88.7456	87.9000	87.9000	87.9000	87.9000	89.4528	89.9569	87.9000	(216)
Fuel for water heating, kWh/month	215.1010	189.1150	197.5854	176.0063	172.4724	153.5095	145.4560	162.3400	162.9151	182.6595	194.5045	209.2277	(219)
Water heating fuel used												2160.8924	(219)
Annual totals kWh/year													
Space heating fuel - main system												4001.7448	(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)												443.5305	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.14 * 966 * 1.00) =										-880.7985		-880.7985	(233)
Total delivered energy for all uses												5800.3692	(238)

10a. Fuel costs - using BEDF prices (491)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4001.7448	3.6300	145.2633	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2160.8924	3.6300	78.4404	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	443.5305	19.4400	86.2223	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-880.7985	19.4400	-171.2272	(252)
Total energy cost			248.2788	(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	4001.7448	0.2160	864.3769	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2160.8924	0.2160	466.7528	(264)
Space and water heating			1331.1296	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	443.5305	0.5190	230.1923	(268)
Energy saving/generation technologies				
PV Unit	-880.7985	0.5190	-457.1344	(269)
Total kg/year			1143.1126	(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	4001.7448	1.2200	4882.1286	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2160.8924	1.2200	2636.2887	(264)
Space and water heating			7518.4173	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	443.5305	3.0700	1361.6387	(268)
Energy saving/generation technologies				
PV Unit	-880.7985	3.0700	-2704.0513	(269)
Primary energy kWh/year			6406.2548	(272)
Primary energy kWh/m2/year			54.5957	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

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

(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	+ 1.0	-£ 28	-197 kg (17.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£28 1.68 kg/m²	B 89	B 90
Total Savings	£28 1.68 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 491 TEST (28 Feb 2022)
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	£101	£111	-£10
Mains gas	£319	£281	£37
Space heating	£255	£255	£0
Water heating	£78	£51	£28
Lighting	£86	£86	£0
Generated (PV)	-£171	-£171	£0
Total cost of fuels	£249	£221	£27
Total cost of uses	£248	£221	£28
Delivered energy	49 kWh/m²	41 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	45 kWh/m²	9 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6700 (1b)	x 2.3900 (2b)	= 140.2213 (1b) - (3b)
First floor	58.6700 (1c)	x 2.6800 (2c)	= 157.2356 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.4569 (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) =					40.0000 / (5) = 0.1345 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3350 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3350 (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	0.4271	0.4187	0.4103	0.3685	0.3601	0.3182	0.3182	0.3099	0.3350	0.3601	0.3768	0.3936 (22b)
Effective ac	0.5912	0.5877	0.5842	0.5679	0.5648	0.5506	0.5506	0.5480	0.5561	0.5648	0.5710	0.5775 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			26.7000	1.1450	30.5725		(27)
Ground Floor			58.6700	0.1200	7.0404	84.0000	4928.2800 (28a)
Brick and Block	170.1500	28.8200	141.3300	0.2400	33.9192	42.2200	5966.9526 (29a)
Pitched Roof	58.6700		58.6700	0.1000	5.8670	9.1000	533.8970 (30)
Total net area of external elements Aum(A, m ²)			287.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7311		(33)
GF Block			57.8100			75.0000	4335.7500 (32c)
GF Stud			34.4900			9.0000	310.4100 (32c)
FF Stud			125.9700			9.0000	1133.7300 (32c)
Internal Floor 1			58.6700			18.0000	1056.0600 (32d)
Internal Ceiling 1			58.6700			18.0000	1056.0600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19321.1396 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							164.6594 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7939 (36)
Total fabric heat loss						(33) + (36) =	86.5250 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	58.0330	57.6853	57.3446	55.7441	55.4446	54.0506	54.0506	53.7925	54.5876	55.4446	56.0504	56.6837 (38)
Average = Sum(39)m / 12 =	144.5580	144.2104	143.8696	142.2691	141.9696	140.5756	140.5756	140.3175	141.1126	141.9696	142.5754	143.2088 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2320	1.2290	1.2261	1.2125	1.2099	1.1980	1.1980	1.1958	1.2026	1.2099	1.2151	1.2205 (40)
HLP (average)												1.2124 (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												2.8524 (42)
Average daily hot water use (litres/day)												101.9451 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1396	108.0618	103.9840	99.9062	95.8284	91.7505	91.7505	95.8284	99.9062	103.9840	108.0618	112.1396 (44)
Energy conte	166.2997	145.4468	150.0881	130.8504	125.5541	108.3436	100.3963	115.2062	116.5822	135.8653	148.3076	161.0524 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9927 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9450	21.8170	22.5132	19.6276	18.8331	16.2515	15.0594	17.2809	17.4873	20.3798	22.2461	24.1579 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8655	170.3433	177.6405	157.4949	153.0616	134.9348	127.8558	142.6968	143.2024	163.3940	174.9702	188.6099 (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												1.1307 (H8)
Utilisation factor												0.5870 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.9451 (H14)
Volume ratio Veff/V												0.7357 (H15)
Solar storage volume factor												0.9386 (H16)
Solar input	-25.4802	-42.5191	-72.4150	-97.0503	-119.8975	-117.8784	-116.3205	-101.6298	-79.5966	-54.3551	-30.2232	-878.6884 (H17)
Solar input (sum of months) = Sum (63)m =												-878.6884 (63)
Output from w/h	168.3853	127.8242	105.2255	60.4445	33.1641	17.0565	11.5353	41.0670	63.6058	109.0390	144.7470	167.2873 (64)
Total per year (kWh/year) = Sum (64)m =												1049.3814 (64)
Heat gains from water heating, kWh/month	62.1861	54.5852	56.7924	50.1689	48.6236	42.6721	40.2467	45.1787	45.4186	52.0574	55.9779	60.4393 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7863	55.7663	45.3522	34.3345	25.6655	21.6679	23.4129	30.4330	40.8470	51.8647	60.5338	64.5314	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.4607	424.8238	413.8290	390.4224	360.8758	333.1061	314.5543	310.1912	321.1860	344.5926	374.1392	401.9089	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	(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)	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	(71)
Water heating gains (Table 5)	83.5835	81.2280	76.3339	69.6790	65.3543	59.2667	54.0950	60.7241	63.0814	69.9696	77.7471	81.2356	(72)
Total internal gains	681.8460	676.8335	650.5305	609.4513	566.9110	529.0561	507.0775	516.3637	540.1299	581.4423	627.4355	662.6913	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				5.7600	10.6334		0.6300	0.7000	0.7700		18.7183 (74)	
East				11.4800	19.6403		0.6300	0.7000	0.7700		68.9066 (76)	
West				9.4600	19.6403		0.6300	0.7000	0.7700		56.7819 (80)	
Solar gains	144.4069	281.6451	465.7034	688.1856	855.2653	881.6783	836.8012	710.1747	544.0201	334.3311	179.8103	118.9647 (83)
Total gains	826.2528	958.4786	1116.2338	1297.6369	1422.1762	1410.7345	1343.8787	1226.5383	1084.1500	915.7734	807.2458	781.6559 (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	37.1268	37.2163	37.3045	37.7242	37.8037	38.1786	38.1786	38.2489	38.0333	37.8037	37.6431	37.4766
alpha	3.4751	3.4811	3.4870	3.5149	3.5202	3.5452	3.5452	3.5499	3.5356	3.5202	3.5095	3.4984
util living area	0.9840	0.9725	0.9441	0.8735	0.7490	0.5839	0.4439	0.4993	0.7359	0.9201	0.9742	0.9867 (86)
MIT	19.2801	19.5061	19.8895	20.3654	20.7244	20.9177	20.9762	20.9641	20.8097	20.3154	19.7106	19.2391 (87)
Th 2	19.8945	19.8969	19.8992	19.9101	19.9121	19.9216	19.9216	19.9233	19.9179	19.9121	19.9080	19.9037 (88)
util rest of house	0.9804	0.9664	0.9315	0.8454	0.6959	0.5024	0.3421	0.3934	0.6613	0.8958	0.9674	0.9837 (89)
MIT 2	18.3431	18.5677	18.9439	19.4034	19.7219	19.8790	19.9137	19.9104	19.8053	19.3702	18.7805	18.3093 (90)
Living area fraction												0.1415 (91)
MIT	18.4756	18.7004	19.0777	19.5395	19.8637	20.0260	20.0640	20.0595	19.9474	19.5039	18.9121	18.4409 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4756	18.7004	19.0777	19.5395	19.8637	20.0260	20.0640	20.0595	19.9474	19.5039	18.9121	18.4409 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9741	0.9577	0.9197	0.8342	0.6933	0.5108	0.3560	0.4074	0.6636	0.8845	0.9591	0.9782	(94)
Useful gains	804.8919	917.8877	1026.6394	1082.5158	986.0645	720.5805	478.3819	499.6584	719.3994	810.0077	774.2245	764.5994	(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	2049.2011	1990.1624	1809.5436	1513.6669	1158.9989	762.7606	486.9606	513.4915	825.1464	1264.0905	1684.1166	2039.4145	(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	925.7660	720.5687	582.4807	310.4288	128.6632	0.0000	0.0000	0.0000	0.0000	337.8376	655.1223	948.4625	(98)
Space heating												4609.3298	(98)
Space heating per m2											(98) / (4) =	39.2818	(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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5081.9512 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	925.7660	720.5687	582.4807	310.4288	128.6632	0.0000	0.0000	0.0000	0.0000	337.8376	655.1223	948.4625	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1020.6902	794.4528	642.2058	342.2589	141.8558	0.0000	0.0000	0.0000	0.0000	372.4780	722.2958	1045.7139	(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	168.3853	127.8242	105.2255	60.4445	33.1641	17.0565	11.5353	41.0670	63.6058	109.0390	144.7470	167.2873	(64)
Efficiency of water heater	90.2575	90.2668	90.2601	90.2316	90.1117	87.9000	87.9000	87.9000	87.9000	90.0005	90.1802	90.2689	(216)
(217)m	90.2575	90.2668	90.2601	90.2316	90.1117	87.9000	87.9000	87.9000	87.9000	90.0005	90.1802	90.2689	(217)
Fuel for water heating, kWh/month	186.5609	141.6071	116.5804	66.9882	36.8033	19.4044	13.1232	46.7201	72.3616	121.1538	160.5087	185.3212	(219)
Water heating fuel used												1167.1328	(219)
Annual totals kWh/year													
Space heating fuel - main system												5081.9512	(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)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												443.5305	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.14 * 853 * 1.00) =										-777.9633		-777.9633	(233)
Total delivered energy for all uses												6039.6513	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5081.9512	3.4800	176.8519	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1167.1328	3.4800	40.6162	(247)
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	443.5305	13.1900	58.5017	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-777.9633	13.1900	-102.6134	(252)
Total energy cost			309.8439	(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] =	0.8016 (257)
SAP value			88.8174
SAP rating (Section 12)			89 (258)
SAP band			B

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

Energy	Emission factor	Emissions
--------	-----------------	-----------

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	5081.9512	0.2160	1097.7015 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1167.1328	0.2160	252.1007 (264)
Space and water heating			1349.8022 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	443.5305	0.5190	230.1923 (268)
Energy saving/generation technologies			
PV Unit	-777.9633	0.5190	-403.7629 (269)
Total kg/year			1241.1066 (272)
CO2 emissions per m2			10.5800 (273)
EI value			89.7556
EI rating			90 (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	58.6700 (1b)	x 2.3900 (2b)	= 140.2213 (1b) - (3b)
First floor	58.6700 (1c)	x 2.6800 (2c)	= 157.2356 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.4569 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =							
Pressure test										40.0000 / (5) =							0.1345 (8)
Measured/design AP50										Yes							4.0100
Infiltration rate																	0.3350 (18)
Number of sides sheltered																	0 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							1.0000 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3350 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000	(22)				
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250	(22a)				
Adj infilt rate	0.3936	0.3685	0.3685	0.3350	0.3433	0.3266	0.3266	0.3182	0.3182	0.3433	0.3350	0.3433	(22b)				
Effective ac	0.5775	0.5679	0.5679	0.5561	0.5589	0.5533	0.5533	0.5506	0.5506	0.5589	0.5561	0.5589	(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						
Front Door			2.1200	1.1000	2.3320			(26)					
Windows (Uw = 1.20)			26.7000	1.1450	30.5725			(27)					
Ground Floor			58.6700	0.1200	7.0404	84.0000	4928.2800	(28a)					
Brick and Block	170.1500	28.8200	141.3300	0.2400	33.9192	42.2200	5966.9526	(29a)					
Pitched Roof	58.6700		58.6700	0.1000	5.8670	9.1000	533.8970	(30)					
Total net area of external elements Aum(A, m2)			287.4900					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7311			(33)					
GF Block			57.8100			75.0000	4335.7500	(32c)					
GF Stud			34.4900			9.0000	310.4100	(32c)					
FF Stud			125.9700			9.0000	1133.7300	(32c)					
Internal Floor 1			58.6700			18.0000	1056.0600	(32d)					
Internal Ceiling 1			58.6700			18.0000	1056.0600	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19321.1396	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							164.6594	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7939	(36)					
Total fabric heat loss						(33) + (36) =	86.5250	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 56.6837	Feb 55.7441	Mar 55.7441	Apr 54.5876	May 54.8664	Jun 54.3156	Jul 54.3156	Aug 54.0506	Sep 54.0506	Oct 54.8664	Nov 54.5876	Dec 54.8664	(38)
Heat transfer coeff	143.2088	142.2691	142.2691	141.1126	141.3914	140.8407	140.8407	140.5756	140.5756	141.3914	141.1126	141.3914	(39)
Average = Sum(39)m / 12 =												141.4149	(39)
HLP	Jan 1.2205	Feb 1.2125	Mar 1.2125	Apr 1.2026	May 1.2050	Jun 1.2003	Jul 1.2003	Aug 1.1980	Sep 1.1980	Oct 1.2050	Nov 1.2026	Dec 1.2050	(40)
HLP (average)												1.2052	(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												2.8524 (42)
Average daily hot water use (litres/day)												101.9451 (43)
Daily hot water use	Jan 112.1396	Feb 108.0618	Mar 103.9840	Apr 99.9062	May 95.8284	Jun 91.7505	Jul 91.7505	Aug 95.8284	Sep 99.9062	Oct 103.9840	Nov 108.0618	Dec 112.1396 (44)
Energy conte	166.2997	145.4468	150.0881	130.8504	125.5541	108.3436	100.3963	115.2062	116.5822	135.8653	148.3076	161.0524 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9927 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	24.9450	21.8170	22.5132	19.6276	18.8331	16.2515	15.0594	17.2809	17.4873	20.3798	22.2461	24.1579 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8655	170.3433	177.6405	157.4949	153.0616	134.9348	127.8558	142.6968	143.2024	163.3940	174.9702	188.6099 (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												1.2632 (H8)
Utilisation factor												0.5469 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.9451 (H14)
Volume ratio Veff/V												0.7357 (H15)
Solar storage volume factor												0.9386 (H16)
Solar input	-29.8422	-42.4389	-73.6424	-99.0615	-115.1161	-125.2129	-118.7210	-108.2620	-84.7364	-58.5668	-35.2965	-914.5262 (H17)
Solar input (sum of months) = Sum (63)m =												-914.5262 (63)
Output from w/h	164.0234	127.9044	103.9981	58.4334	37.9454	9.7219	9.1349	34.4348	58.4659	104.8272	139.6737	164.9804 (64)
Total per year (kWh/year) = Sum (64)m =												1013.5436 (64)
Heat gains from water heating, kWh/month	62.1861	54.5852	56.7924	50.1689	48.6236	42.6721	40.2467	45.1787	45.4186	52.0574	55.9779	60.4393 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	171.1454	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7863	55.7663	45.3522	34.3345	25.6655	21.6679	23.4129	30.4330	40.8470	51.8647	60.5338	64.5314	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.4607	424.8238	413.8290	390.4224	360.8758	333.1061	314.5543	310.1912	321.1860	344.5926	374.1392	401.9089	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	54.9670	(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)	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	-114.0969	(71)
Water heating gains (Table 5)	83.5835	81.2280	76.3339	69.6790	65.3543	59.2667	54.0950	60.7241	63.0814	69.9696	77.7471	81.2356	(72)
Total internal gains	681.8460	676.8335	650.5305	609.4513	566.9110	529.0561	507.0775	516.3637	540.1299	581.4423	627.4355	662.6913	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				5.7600	13.4684		0.6300	0.7000		0.7700		23.7089 (74)	
East				11.4800	25.1733		0.6300	0.7000		0.7700		88.3188 (76)	
West				9.4600	25.1733		0.6300	0.7000		0.7700		72.7784 (80)	
Solar gains	184.8060	307.1108	516.4537	763.3420	889.5085	1012.9778	924.3814	820.9785	630.7583	393.3655	229.4677	144.0415 (83)	
Total gains	866.6520	983.9442	1166.9841	1372.7933	1456.4195	1542.0340	1431.4590	1337.3422	1170.8881	974.8078	856.9032	806.7328 (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	37.4766	37.7242	37.7242	38.0333	37.9583	38.1068	38.1068	38.1786	38.1786	37.9583	38.0333	37.9583	
alpha	3.4984	3.5149	3.5149	3.5356	3.5306	3.5405	3.5405	3.5452	3.5452	3.5306	3.5356	3.5306	
util living area	0.9765	0.9634	0.9224	0.8216	0.6668	0.4486	0.3206	0.3316	0.6078	0.8666	0.9574	0.9805	(86)
MIT	19.5359	19.7198	20.1042	20.5561	20.8423	20.9713	20.9936	20.9932	20.9181	20.5527	19.9944	19.5161	(87)
Th 2	19.9037	19.9101	19.9101	19.9179	19.9160	19.9198	19.9198	19.9216	19.9216	19.9160	19.9179	19.9160	(88)
util rest of house	0.9709	0.9550	0.9047	0.7831	0.6001	0.3604	0.2176	0.2222	0.5125	0.8254	0.9455	0.9758	(89)
MIT 2	18.6035	18.7882	19.1592	19.5820	19.8190	19.9085	19.9186	19.9204	19.8831	19.5910	19.0665	18.5937	(90)
Living area fraction									fLA = Living area / (4) =			0.1415	(91)
MIT	18.7354	18.9200	19.2929	19.7198	19.9638	20.0588	20.0707	20.0721	20.0295	19.7271	19.1978	18.7242	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7354	18.9200	19.2929	19.7198	19.9638	20.0588	20.0707	20.0721	20.0295	19.7271	19.1978	18.7242	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9630	0.9451	0.8924	0.7751	0.6033	0.3721	0.2322	0.2377	0.5227	0.8168	0.9352	0.9688	(94)
Useful gains	834.6110	929.8903	1041.4739	1064.0893	878.6429	573.7891	332.4032	317.8858	612.0807	796.2655	801.3757	781.5360	(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	1881.1016	1838.1156	1663.5381	1357.4798	970.4819	585.7348	333.8844	319.4052	650.7988	1078.4029	1495.4768	1841.5063	(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	778.5890	610.3274	462.8157	211.2412	68.3282	0.0000	0.0000	0.0000	0.0000	209.9103	499.7528	788.6179	(98)
Space heating												3629.5825	(98)
Space heating per m2											(98) / (4) =	30.9322	(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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4001.7448 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	778.5890	610.3274	462.8157	211.2412	68.3282	0.0000	0.0000	0.0000	0.0000	209.9103	499.7528	788.6179	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	858.4223	672.9078	510.2709	232.9010	75.3343	0.0000	0.0000	0.0000	0.0000	231.4336	550.9954	869.4795	(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	164.0234	127.9044	103.9981	58.4334	37.9454	9.7219	9.1349	34.4348	58.4659	104.8272	139.6737	164.9804	(64)
Efficiency of water heater	90.2000	90.2022	90.1730	90.0783	89.6800	87.9000	87.9000	87.9000	87.9000	89.7478	90.0733	90.2029	(217)
Fuel for water heating, kWh/month	181.8440	141.7975	115.3318	64.8696	42.3120	11.0602	10.3924	39.1750	66.5141	116.8020	155.0668	182.8993	(219)
Water heating fuel used												1128.0647	(219)
Annual totals kWh/year													
Space heating fuel - main system												4001.7448	(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)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												443.5305	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.14 * 966 * 1.00) =									-880.7985			-880.7985	(233)
Total delivered energy for all uses												4817.5415	(238)

10a. Fuel costs - using BEDF prices (491)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4001.7448	3.6300	145.2633	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1128.0647	3.6300	40.9487	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Pump for solar water heating	50.0000	19.4400	9.7200	(249)
Energy for lighting	443.5305	19.4400	86.2223	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-880.7985	19.4400	-171.2272	(252)
Total energy cost			220.5072	(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	4001.7448	0.2160	864.3769	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1128.0647	0.2160	243.6620	(264)
Space and water heating			1108.0388	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	443.5305	0.5190	230.1923	(268)
Energy saving/generation technologies				
PV Unit	-880.7985	0.5190	-457.1344	(269)
Total kg/year			945.9718	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	4001.7448	1.2200	4882.1286	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1128.0647	1.2200	1376.2389	(264)
Space and water heating			6258.3675	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	443.5305	3.0700	1361.6387	(268)
Energy saving/generation technologies				
PV Unit	-880.7985	3.0700	-2704.0513	(269)
Primary energy kWh/year			5299.7050	(272)
Primary energy kWh/m2/year			45.1654	(273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 67	Issued on Date	18/03/2022
Assessment Reference	As Built	Prop Type Ref	Lh
Project	5 Fred Woolley Walk, West End, Southampton, SO30 3LF		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.75	TER	18.02
Environmental	88 B	% DER<TER	23.71		
CO ₂ Emissions (t/year)	1.14	DFEE	49.18	TREE	61.58
General Requirements Compliance	Pass	% DFEE<TFEE	20.14		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Earthwool Loft Roll 40						
	Main construction	150	0.0400	3.7500	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Earthwool Loft Roll 40						
	Main construction	200	0.0400	5.0000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Earthwool Loft Roll 40						
	Main construction	100	0.0400	2.5000	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 11.200 m² K/W Lower limit = 10.901 m² K/W Average = 11.050 m² K/W
Total correction = 0.0065 m² K/W U-value (unrounded) = 0.1 W/m² K

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 67	Issued on Date	18/03/2022
Assessment Reference	As Built	Prop Type Ref	Lh
Project	5 Fred Woolley Walk, West End, Southampton, SO30 3LF		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.75	TER	18.02
Environmental	88 B	% DER<TER	23.71		
CO ₂ Emissions (t/year)	1.14	DFEE	49.18	TFEE	61.58
General Requirements Compliance	Pass	% DFEE<TFEE	20.14		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
------------------	--	-------------	-----------

Client	Foreman Homes, FORE
--------	---------------------

Building Elements

Wall 000001

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Brick, outer leaf						
	Main construction	102	0.7700	0.1325	82.81		
	Main construction	102	0.9407	0.1084	17.19		
Layer 2	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Supabloc						
	Main construction	100	0.1100	0.9091	94.04	460	1000
	Main construction	100	0.8803	0.1136	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 5	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.321 m ² K/W	Lower limit = 4.110 m ² K/W	Average = 4.215 m ² K/W
	Total correction = 0.0002 m ² K/W	U-value (unrounded) = 0.24 W/m ² K	

Unheated space: None		
Total thickness: 330 mm	U-value: 0.24 W/m² K	Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 67	Issued on Date	18/03/2022
Assessment Reference	As Built	Prop Type Ref	Lh
Project	5 Fred Woolley Walk, West End, Southampton, SO30 3LF		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.75	TER	18.02
Environmental	88 B	% DER<TER	23.71		
CO ₂ Emissions (t/year)	1.14	DFEE	49.18	TFEE	61.58
General Requirements Compliance	Pass	% DFEE<TFEE	20.14		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
------------------	--	-------------	-----------

Client	Foreman Homes, FORE
--------	---------------------

Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

Area = 35.11 m², Perimeter = 16.79 m, Wall thickness = 275.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: none

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Concrete, medium density						
	Main construction	100	1.3500	0.0741	100.00		
Layer 2	Polythene, 1000 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 3	Celotex XR4000						
	Main construction	150	0.0220	6.8182	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Polythene, 500 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 5	Screed						
	Main construction	70	1.1500	0.0609	100.00	1200	1000
Int surface				0.1700			

Total resistance: Upper limit = 6.953 m² K/W Lower limit = 6.953 m² K/W Average = 6.953 m² K/W

Total correction = 0.0096 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 321 mm

U-value: 0.12 W/m² K

Kappa: 84.00 kJ/m² K

CONDENSATION RISK ANALYSIS

Property Reference	SAP 0647 Plot 67	Issued on Date	18/03/2022
Assessment Reference	As Built	Prop Type Ref	Lh
Project	5 Fred Woolley Walk, West End, Southampton, SO30 3LF		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.75	TER	18.02
Environmental	88 B	% DER<TER	23.71		
CO ₂ Emissions (t/year)	1.14	DFEE	49.18	TFEE	61.58
General Requirements Compliance	Pass	% DFEE<TFEE	20.14		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Roof - 000002

Environmental conditions

External conditions	Temperature:	5	°C	Relative Humidity:	95	%
Internal conditions	Temperature:	15	°C	Relative Humidity:	65	%

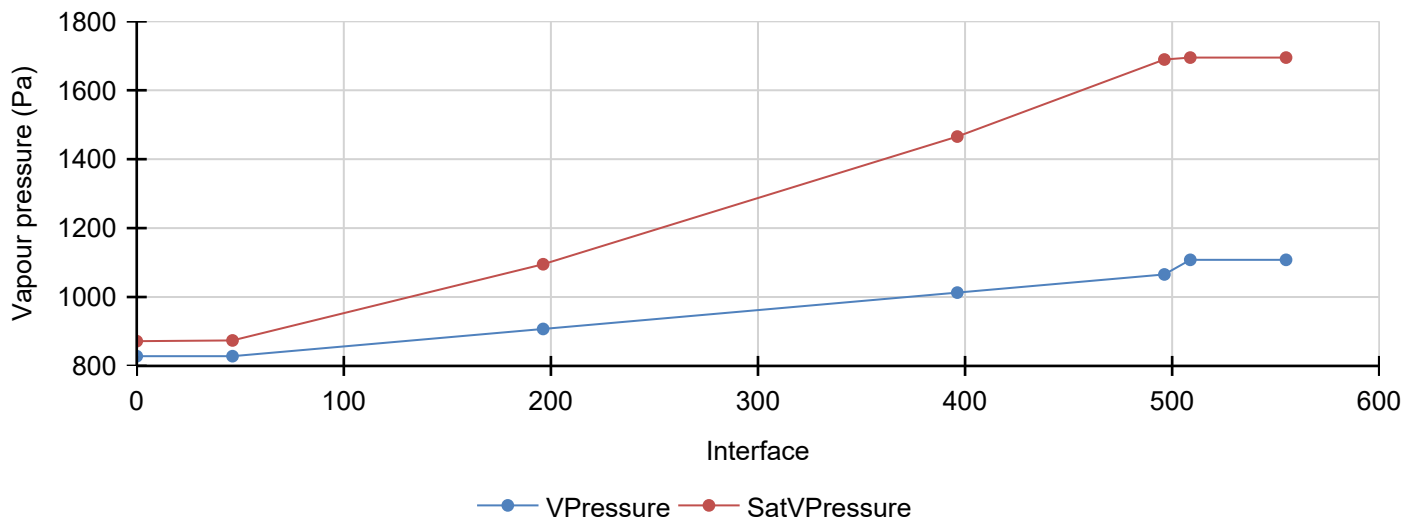
Table of layers

Layer	Thickness mm	Thermal conduct. W/m.K	Thermal resistance m ² .K/W	Cumulative thermal resistance m ² .K/W	Vapour resistivity GN.s/kg.m	Vapour resistance GN.s/kg.m	Cumulative vapour resistance GN.s/kg.m
External surface	-	0.0000	0.0400	0.0400	0.0	0.00	0.00
1.Earthwool Loft Roll 40	150.0	0.0400	3.7500	3.7900	7.0	1.05	1.05
2.Earthwool Loft Roll 40	200.0	0.0400	5.0000	8.7900	7.0	1.40	2.45
3.Earthwool Loft Roll 40	100.0	0.0400	2.5000	11.2900	7.0	0.70	3.15
4.Plasterboard, standard	12.5	0.2100	0.0595	11.3495	45.0	0.56	3.71
Internal surface	-	0.0000	0.1000	11.3495	0.0	0.00	3.71

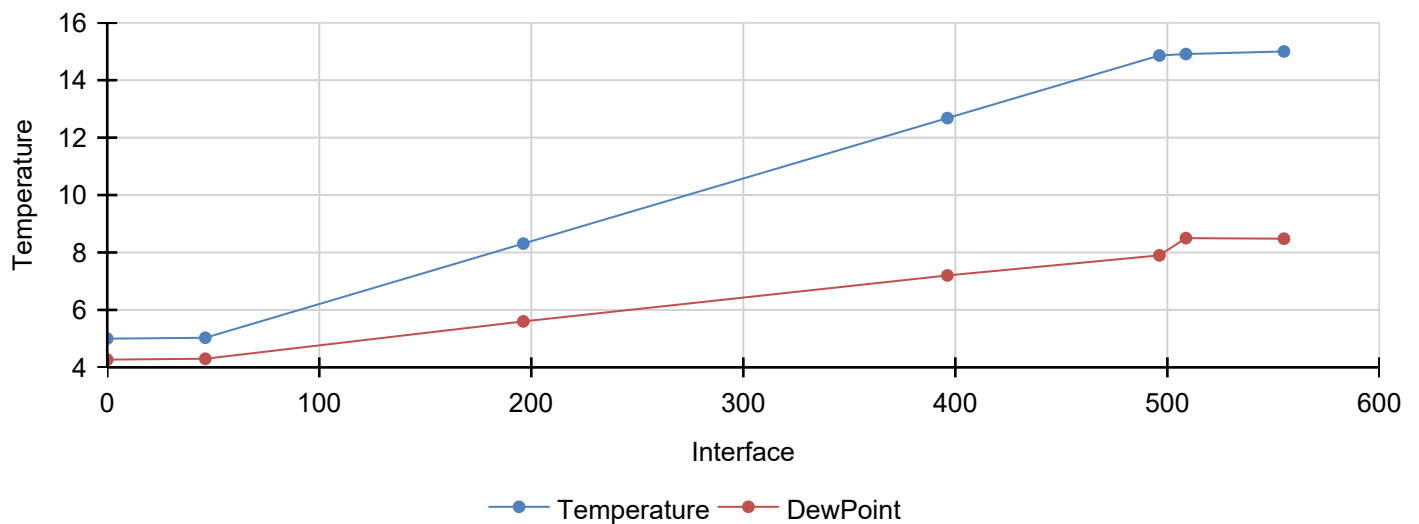
Vapour pressure table

Interface - between layers	Interface temp. °C	Vapour pressure Pa	Satur. vapour pressure Pa	Dew point °C	Cond. rate g/m ² h	Cond. rate 60 days g/m ² h	Cond. risk Y/N
External surface	5.00	828.3	871.9	4.27	0.00	0.00	No
1. External surface / Earthwool Loft Roll 40	5.03	828.3	874.0	4.3	0.00	0.00	No
2. Earthwool Loft Roll 40 / Earthwool Loft Roll 40	8.31	907.3	1095.1	5.6	0.00	0.00	No
3. Earthwool Loft Roll 40 / Earthwool Loft Roll 40	12.68	1012.8	1465.6	7.2	0.00	0.00	No
4. Earthwool Loft Roll 40 / Plasterboard, standard	14.86	1065.5	1689.2	7.9	0.00	0.00	No
Plasterboard, standard / Internal surface	14.91	1107.9	1694.8	8.5	0.00	0.00	No
Internal surface	15.00	1107.9	1694.8	8.48	0.00	0.00	No

CONDENSATION RISK ANALYSIS



Interface temperature / Dew point graphical representation



CONDENSATION RISK ANALYSIS

Wall - 000001

Environmental conditions

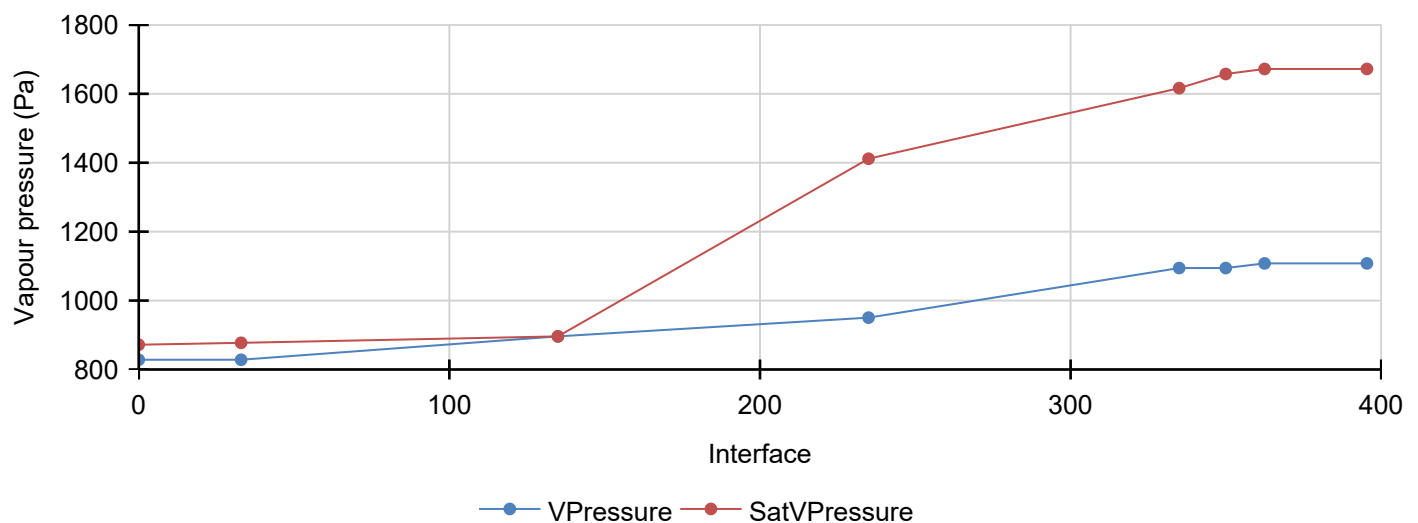
External conditions Temperature: °C Relative Humidity: %
Internal conditions Temperature: °C Relative Humidity: %

Table of layers

Layer	Thickness mm	Thermal conduct. W/m.K	Thermal resistance m².K/W	Cumulative thermal resistance m².K/W	Vapour resistivity GN.s/kg.m	Vapour resistance GN.s/kg.m	Cumulative vapour resistance GN.s/kg.m
External surface	-	0.0000	0.0400	0.0400	0.0	0.00	0.00
1.Brick, outer leaf	102.0	0.7700	0.1325	0.1725	50.0	5.10	5.10
2.Supafil 34	100.0	0.0340	2.9412	3.1136	0.0	0.00	5.10
3.Supabloc	100.0	0.1100	0.9091	4.0227	60.0	6.00	11.10
4.airspace/plaster dabs	15.0	0.0000	0.1700	4.1927	0.0	0.00	11.10
5.Plasterboard, standard	12.5	0.2100	0.0595	4.2523	45.0	0.56	11.66
Internal surface	-	0.0000	0.1300	4.2523	0.0	0.00	11.66

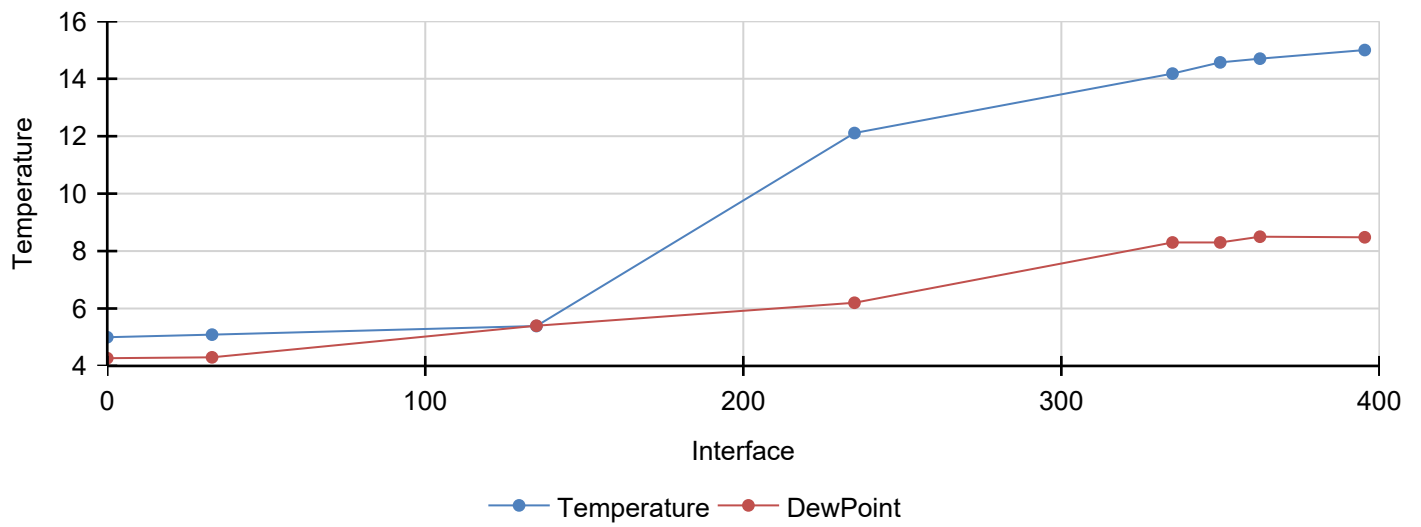
Vapour pressure table

Interface - between layers	Interface temp. °C	Vapour pressure Pa	Satur. vapour pressure Pa	Dew point °C	Cond. rate g/m² h	Cond. rate 60 days g/m² h	Cond. risk Y/N
External surface	5.00	828.3	871.9	4.27	0.00	0.00	No
1. External surface / Brick, outer leaf	5.09	828.3	877.4	4.3	0.00	0.00	No
2. Brick, outer leaf / Supafil 34	5.39	896.1	896.1	5.4	0.07	98.32	Yes
3. Supafil 34 / Supabloc	12.11	950.5	1411.6	6.2	0.00	0.00	No
4. Supabloc / airspace/plaster dabs	14.18	1094.4	1616.4	8.3	0.00	0.00	No
5. airspace/plaster dabs / Plasterboard, standard	14.57	1094.4	1657.5	8.3	0.00	0.00	No
Plasterboard, standard / Internal surface	14.70	1107.9	1672.1	8.5	0.00	0.00	No
Internal surface	15.00	1107.9	1672.1	8.48	0.00	0.00	No



Interface temperature / Dew point graphical representation

CONDENSATION RISK ANALYSIS



CONDENSATION RISK ANALYSIS

Floor - 000003

Environmental conditions

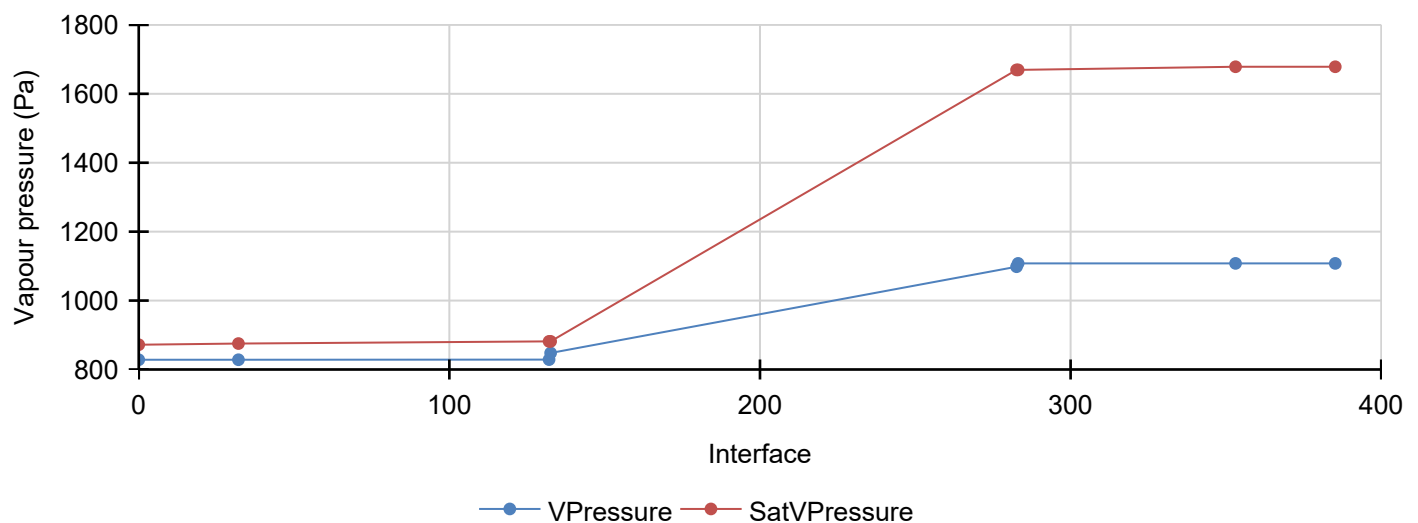
External conditions Temperature: °C Relative Humidity: %
Internal conditions Temperature: °C Relative Humidity: %

Table of layers

Layer	Thickness mm	Thermal conduct. W/m.K	Thermal resistance m².K/W	Cumulative thermal resistance m².K/W	Vapour resistivity GN.s/kg.m	Vapour resistance GN.s/kg.m	Cumulative vapour resistance GN.s/kg.m
External surface	-	0.0000	0.0400	0.0400	0.0	0.00	0.00
1.Concrete, medium density	100.0	1.3500	0.0741	0.1141	100.0	10.00	10.00
2.Polythene,1000 gauge	0.5	0.0000	0.0000	0.1141	0.000	500.00	510.00
3.Celotex XR4000	150.0	0.0220	6.8182	6.9323	43373.0	6505.95	7015.95
4.Polythene, 500 gauge	0.5	0.0000	0.0000	6.9323	0.000	250.00	7265.95
5.Screed	70.0	1.1500	0.0609	6.9931	0.0	0.00	7265.95
Internal surface	-	0.0000	0.1700	6.9931	0.0	0.00	7265.95

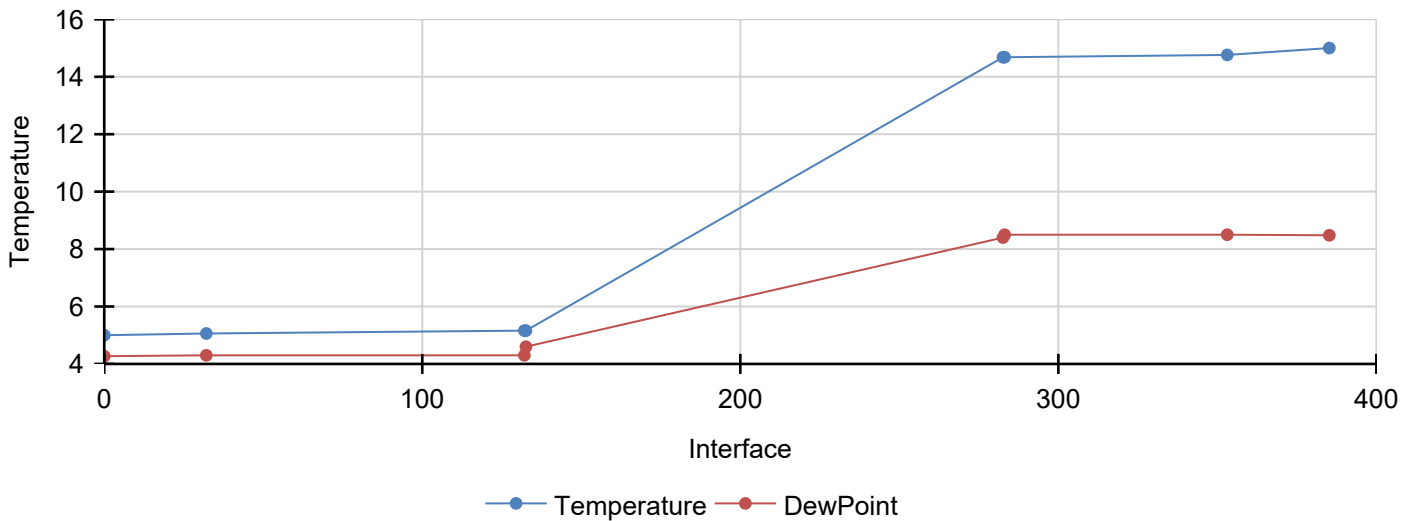
Vapour pressure table

Interface - between layers	Interface temp. °C	Vapour pressure Pa	Satur. vapour pressure Pa	Dew point °C	Cond. rate g/m² h	Cond. rate 60 days g/m² h	Cond. risk Y/N
External surface	5.00	828.3	871.9	4.27	0.00	0.00	No
1. External surface / Concrete, medium density	5.06	828.3	875.3	4.3	0.00	0.00	No
2. Concrete, medium density / Polythene,1000 gauge	5.16	828.7	881.6	4.3	0.00	0.00	No
3. Polythene,1000 gauge / Celotex XR4000	5.16	847.9	881.6	4.6	0.00	0.00	No
4. Celotex XR4000 / Polythene, 500 gauge	14.68	1098.2	1669.4	8.4	0.00	0.00	No
5. Polythene, 500 gauge / Screed	14.68	1107.9	1669.4	8.5	0.00	0.00	No
Screed / Internal surface	14.76	1107.9	1678.5	8.5	0.00	0.00	No
Internal surface	15.00	1107.9	1678.5	8.48	0.00	0.00	No



Interface temperature / Dew point graphical representation

CONDENSATION RISK ANALYSIS



SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 67	Issued on Date	18/03/2022
Assessment Reference	As Built	Prop Type Ref	Lh
Property	5 Fred Woolley Walk, West End, Southampton, SO30 3LF		
SAP Rating	88 B	DER	13.75
Environmental	88 B	TER	18.02
CO ₂ Emissions (t/year)	1.14	% DER<TER	23.71
General Requirements Compliance	Pass	DLEE	49.18
		TFEE	61.58
		% DLEE<TFEE	20.14
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2020
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	33.56 m	58.67 m ²
	1st Storey:	33.56 m	58.67 m ²
			2.39 m
			2.68 m

7.0 Living Area	16.60	m ²
-----------------	-------	----------------

8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	164.66	kJ/m²K

9.0 External Walls			U-Value	Kappa	Gross Area	Nett Area
Description	Type	Construction	(W/m ² K)	(kJ/m ² K)	(m ²)	(m ²)
Brick and Block	Cavity Wall	Other	0.24	42.22	170.15	141.33

9.1 Party Walls			U-Value	Kappa	Area
Description	Type	Construction	(W/m ² K)	(kJ/m ² K)	(m ²)
		Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill		70.00	

9.2 Internal Walls			Kappa	Area
Description	Construction		(kJ/m ² K)	(m ²)
GF Block	Dense block, plasterboard on dabs		75.00	57.81
GF Stud	Plasterboard on timber frame		9.00	34.49
FF Stud	Plasterboard on timber frame		9.00	125.97

10.0 External Roofs			U-Value	Kappa	Gross Area	Nett Area
Description	Type	Construction	(W/m ² K)	(kJ/m ² K)	(m ²)	(m ²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	58.67	58.67

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	58.67

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	58.67

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	58.67

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacturer	Solid Door							1.10
Windows	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	West							2.12	
Front Elevation	Window	[1] Brick and Block	West	None	0.00					9.46	
Rear Elevation	Window	[1] Brick and Block	East	None	0.00					11.48	
Side Elevation	Window	[1] Brick and Block	North	None	0.00					5.76	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	1.83	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.01	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	8.40	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.02	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	7.08	0.064	No	Birtley Supatherm
Independently assessed	E3 Sill	17.31	0.021	No	Knauf P5
Independently assessed	E4 Jamb	42.90	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	33.56	0.060	No	CBA - 302
Independently assessed	E6 Intermediate floor within a dwelling	33.56	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	18.84	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	14.72	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	25.25	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	5.05	-0.091	No	Knauf P24

Y-value	0.024	W/m²K
---------	-------	-------

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	4.01	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
---------------------------------------	----

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	23	
Total number of L.E.L. fittings	23	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

0 Main Heating 1		Database	
Description		Gas Combi	
Percentage of Heat		100	%
Database Ref. No.		17515	
Fuel Type		Mains gas	
Main Heating		BGW	
SAP Code		104	
In Winter		90.7	
In Summer		87.9	
Controls		CBE Programmer, room thermostat and TRVs	
PCDF Controls		0	
Delayed Start Stat		No	
Sap Code		2106	
Flue Type		Balanced	
Fan Assisted Flue		Yes	
Is MHS Pumped		Pump in heated space	
Heat Emitter		Radiators	
Flow Temperature		Normal (> 45°C)	
Combi boiler type		Standard Combi	
Combi keep hot type		Gas/Oil, time clock	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Community Heating	None			
28.0 Water Heating	HWP From main heating 1			
Water Heating	Main Heating 1			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery Storage System	No			
Solar Panel	No			
Water use <= 125 litres/person/day	Yes			
SAP Code	901			
29.0 Hot Water Cylinder	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.14	West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£28	B 89	