

PREDICTED ENERGY ASSESSMENT

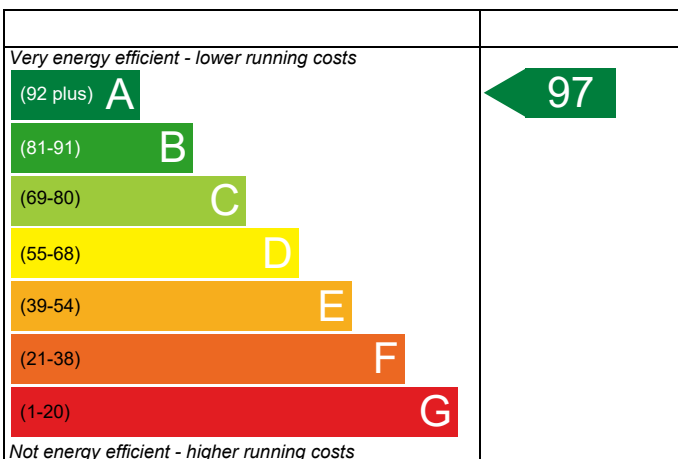
Plot 175

Dwelling type: House, Semi-Detached
Date of assessment: 06/04/2023
Produced by: Scott Binstead
Total floor area: 93.02 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating

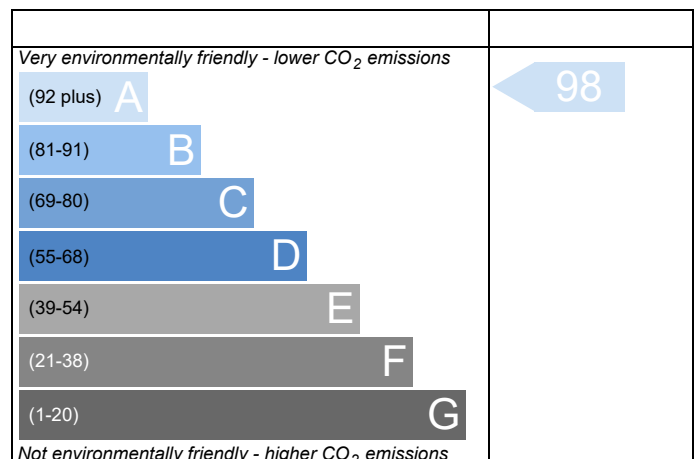


England

EU Directive
2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	175 - PRJ010636	Issued on Date	06/04/2023
Assessment Reference	175 S	Prop Type Ref	Sutherland
Property	Plot 175		

SAP Rating	97 A	DER	4.32	TER	17.69
Environmental	98 A	% DER<TER	75.58		
CO ₂ Emissions (t/year)	-0.03	DFEE	41.92	TFEE	49.64
General Requirements Compliance	Pass	% DFEE<TFEE	15.54		

Assessor Details	Chris Nicholls, , Tel: ,	Assessor ID	U903-0001
Client			

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys		0	+	0	+	0	=	0 * 40 =	0.0000 (6a)			
Number of open flues		0	+	0	+	0	=	0 * 20 =	0.0000 (6b)			
Number of intermittent fans								3 * 10 =	30.0000 (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) =							30.0000 / (5) =	0.1327 (8)			
Pressure test								Yes				
Measured/design AP50								5.0100				
Infiltration rate								0.3832 (18)				
Number of sides sheltered								1 (19)				
Shelter factor								(20) = 1 - [0.075 x (19)] =	0.9250 (20)			
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =	0.3545 (21)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.0000	5.6000	5.6000	5.0000	5.0000	4.4000	4.4000	4.3000	4.7000	5.4000	5.5000	5.9000 (22)
Wind factor	1.5000	1.4000	1.4000	1.2500	1.2500	1.1000	1.1000	1.0750	1.1750	1.3500	1.3750	1.4750 (22a)
Adj infilt rate	0.5317	0.4963	0.4963	0.4431	0.4431	0.3899	0.3899	0.3811	0.4165	0.4785	0.4874	0.5229 (22b)
Effective ac	0.6414	0.6231	0.6231	0.5982	0.5982	0.5760	0.5760	0.5726	0.5867	0.6145	0.6188	0.6367 (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
Windows (Uw = 1.30)			8.0000	1.2357	9.8859		(27)
Solid Door			4.2000	1.2000	5.0400		(26)
Fir - Ground			46.5070	0.2100	9.7665		(28a)
W1 - Brick	94.2940	12.2040	82.0900	0.2400	19.7016	75.6000	3515.9292 (28a)
RF - Ins Joist	46.5070		46.5070	0.1000	4.6507	38.9400	3196.5846 (29a)
Total net area of external elements Aum(A, m ²)			187.3040			5.8200	270.6707 (30)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.0447		(31)
Party Wall			42.0580	0.0000	0.0000	54.0300	2272.3937 (32)
Ground Floor Block			12.4255			54.0300	671.3493 (32c)
Ground Floor Stud			68.0169			5.8200	395.8583 (32c)
1st Floor Stud			109.3269			5.8200	636.2825 (32c)
Internal Floor			46.5000			18.0000	837.0000 (32d)
Internal Ceiling			46.5000			5.8200	270.6300 (32e)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 12066.6985 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							129.7215 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4280 (36)
Total fabric heat loss							(33) + (36) = 53.4727 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	47.8410	46.4819	46.4819	44.6190	44.6190	42.9670	42.9670	42.7122	43.7667	45.8375	46.1568	47.4924	(38)
Average = Sum(39) / 12 =	101.3137	99.9546	99.9546	98.0917	98.0917	96.4398	96.4398	96.1849	97.2394	99.3102	99.6295	100.9652	(39)
												98.6346	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0892	1.0745	1.0745	1.0545	1.0545	1.0368	1.0368	1.0340	1.0454	1.0676	1.0711	1.0854	(40)
Days in month												1.0604	(40)
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6648	(42)		
Average daily hot water use (litres/day)													97.4900	(43)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390	(44)			
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143	(45)			
Energy content (annual)										Total = Sum(45)m =			1533.8973	(45)		
Distribution loss (46)m = 0.15 x (45)m																
	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021	(46)			
Water storage loss:																
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)			
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)			
Combi loss	14.6940	13.2584	14.6451	14.1170	14.5470	14.0310	14.4696	14.5198	14.0778	14.6045	14.1838	14.6790	(61)			
Total heat required for water heating calculated for each month																
	173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933	(62)			
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)			
								Solar input (sum of months) = Sum(63)m =							0.0000	(63)
Output from w/h																
	173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933	(64)			
								Total per year (kWh/year) = Sum(64)m =							1705.7242	(64)
RHI water heating demand													1706	(64)		
Heat gains from water heating, kWh/month																
	56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032	54.8795	(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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.5276	57.3129	46.6099	35.2867	26.3772	22.2688	24.0622	31.2770	41.9799	53.3031	62.2126	66.3210	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	76.0104	73.7533	69.0655	62.6885	58.5472	52.7191	47.7693	54.1156	56.3737	62.9733	70.4212	73.7628	(72)
Total internal gains	615.4520	609.7673	584.8330	546.8156	508.1182	474.0773	454.8178	464.5917	487.0962	525.3362	567.3402	598.8946	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W	
Northeast					3.9540	15.4538	0.7600	0.7200			0.7700			23.1714	(75)
Southwest					4.0460	47.2368	0.7600	0.7200			0.7700			72.4746	(79)
Solar gains	95.6459	144.3401	214.9621	300.0850	345.1881	378.1489	332.7248	306.1867	249.3189	166.8480	111.7666			77.8983	(83)
Total gains	711.0979	754.1074	799.7950	846.9006	853.3063	852.2262	787.5427	770.7784	736.4151	692.1842	679.1069			676.7928	(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	33.0840	33.5338	33.5338	34.1707	34.1707	34.7560	34.7560	34.8481	34.4702	33.7514	33.6433	33.1982		
alpha	3.2056	3.2356	3.2356	3.2780	3.2780	3.3171	3.3171	3.3232	3.2980	3.2501	3.2429	3.2132		
util living area	0.9506	0.9392	0.9158	0.8670	0.7832	0.6399	0.5416	0.5408	0.6991	0.8580	0.9241	0.9539	(86)	
MIT	19.6170	19.7485	19.9721	20.3069	20.6240	20.8627	20.9386	20.9405	20.8193	20.4661	20.0526	19.6240	(87)	
Th 2	20.0097	20.0217	20.0217	20.0381	20.0381	20.0528	20.0528	20.0551	20.0457	20.0274	20.0245	20.0128	(88)	
util rest of house	0.9414	0.9282	0.9003	0.8420	0.7401	0.5706	0.4503	0.4478	0.6292	0.8238	0.9077	0.9451	(89)	
MIT 2	18.7823	18.9192	19.1359	19.4678	19.7586	19.9698	20.0243	20.0280	19.9345	19.6152	19.2207	18.7924	(90)	
Living area fraction													0.1844	(91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

MIT	18.9362	19.0721	19.2901	19.6225	19.9181	20.1344	20.1929	20.1962	20.0976	19.7721	19.3740	18.9457 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7862	18.9221	19.1401	19.4725	19.7681	19.9844	20.0429	20.0462	19.9476	19.6221	19.2240	18.7957 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9270	0.9126	0.8832	0.8248	0.7264	0.5652	0.4493	0.4468	0.6212	0.8068	0.8910	0.9311 (94)	
Useful gains	659.1547	688.2198	706.3465	698.4918	619.8687	481.6547	353.8604	344.4031	457.4846	558.4260	605.0657	630.1848 (95)	
Ext temp.	6.1000	6.4000	7.5000	9.3000	11.9000	14.5000	16.2000	16.3000	14.6000	11.8000	9.0000	6.4000 (96)	
Heat loss rate W													
	1285.2888	1251.6449	1163.4808	997.8361	771.8002	528.9174	370.6074	360.3306	519.9989	776.8097	1018.6166	1251.5374 (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													
	465.8437	378.6217	340.1080	215.5279	113.0370	0.0000	0.0000	0.0000	0.0000	162.4775	297.7567	462.2863 (98)	
Space heating												2435.6587 (98)	
RHI space heating demand												2436 (98)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1327 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3832 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3545 (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	0.4520	0.4431	0.4342	0.3899	0.3811	0.3368	0.3368	0.3279	0.3545	0.3811	0.3988	0.4165 (22b)
Effective ac	0.6021	0.5982	0.5943	0.5760	0.5726	0.5567	0.5567	0.5538	0.5628	0.5726	0.5795	0.5867 (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
Windows (Uw = 1.30)			8.0000	1.2357	9.8859		(27)
Solid Door			4.2000	1.2000	5.0400		(26)
Flr - Ground			46.5070	0.2100	9.7665	75.6000	3515.9292 (28a)
Wl - Brick	94.2940	12.2040	82.0900	0.2400	19.7016	38.9400	3196.5846 (29a)
Rf - Ins Joist	46.5070		46.5070	0.1000	4.6507	5.8200	270.6707 (30)
Total net area of external elements Aum(A, m ²)			187.3040				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.0447		(33)
Party Wall			42.0580	0.0000	0.0000	54.0300	2272.3937 (32)
Ground Floor Block			12.4255			54.0300	671.3493 (32c)
Ground Floor Stud			68.0169			5.8200	395.8583 (32c)
1st Floor Stud			109.3269			5.8200	636.2825 (32c)
Internal Floor			46.5000			18.0000	837.0000 (32d)
Internal Ceiling			46.5000			5.8200	270.6300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 12066.6985 (34)
129.7215 (35)
4.4280 (36)
(33) + (36) = 53.4727 (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	44.9148	44.6190	44.3290	42.9670	42.7122	41.5259	41.5259	41.3062	41.9829	42.7122	43.2277	43.7667 (38)
Heat transfer coeff	98.3876	98.0917	97.8018	96.4398	96.1849	94.9987	94.9987	94.7790	95.4556	96.1849	96.7004	97.2394 (39)
Average = Sum(39)m / 12 =												96.4385 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0577	1.0545	1.0514	1.0368	1.0340	1.0213	1.0213	1.0189	1.0262	1.0340	1.0396	1.0454 (40)
HLP (average)												1.0368 (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
Average daily hot water use (litres/day)
2.6648 (42)
97.4900 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1533.8973 (45)
Distribution loss (46)m = 0.15 x (45)m													
23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (46)		
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)		
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)		
Combi loss	14.6940	13.2584	14.6451	14.1170	14.5470	14.0310	14.4696	14.5198	14.0778	14.6045	14.1838 (61)		
Total heat required for water heating calculated for each month													
173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933 (62)		
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)		
												Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h													
173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933 (64)		
												Total per year (kWh/year) = Sum(64)m =	1705.7242 (64)
Heat gains from water heating, kWh/month													
56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032	54.8795 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.5276	57.3129	46.6099	35.2867	26.3772	22.2688	24.0622	31.2770	41.9799	53.3031	62.2126	66.3210 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539 (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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937 (71)
Water heating gains (Table 5)	76.0104	73.7533	69.0655	62.6885	58.5472	52.7191	47.7693	54.1156	56.3737	62.9733	70.4212	73.7628 (72)
Total internal gains	615.4520	609.7673	584.8330	546.8156	508.1182	474.0773	454.8178	464.5917	487.0962	525.3362	567.3402	598.8946 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g		FF	Access		Gains	
						Specific data or Table 6b		Specific data or Table 6c	factor Table 6d		W	
Northeast				3.9540	11.2829	0.7600		0.7200	0.7700		16.9176 (75)	
Southwest				4.0460	36.7938	0.7600		0.7200	0.7700		56.4521 (79)	

Solar gains	73.3697	130.5951	193.6119	264.9127	319.5597	327.2934	311.3657	269.0609	218.0616	148.3598	88.9033	62.1270 (83)
Total gains	688.8217	740.3624	778.4448	811.7283	827.6779	801.3707	766.1835	733.6526	705.1578	673.6960	656.2436	661.0216 (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	34.0679	34.1707	34.2720	34.7560	34.8481	35.2832	35.2832	35.3650	35.1143	34.8481	34.6623	34.4702
alpha	3.2712	3.2780	3.2848	3.3171	3.3232	3.3522	3.3522	3.3577	3.3410	3.3232	3.3108	3.2980
util living area	0.9654	0.9539	0.9319	0.8846	0.7976	0.6550	0.5105	0.5474	0.7427	0.8928	0.9501	0.9692 (86)
MIT	19.3619	19.5364	19.8377	20.2435	20.6047	20.8592	20.9546	20.9417	20.7719	20.3272	19.7864	19.3309 (87)
Th 2	20.0355	20.0381	20.0407	20.0528	20.0551	20.0656	20.0656	20.0676	20.0616	20.0551	20.0505	20.0457 (88)
util rest of house	0.9595	0.9460	0.9198	0.8629	0.7572	0.5852	0.4149	0.4527	0.6814	0.8684	0.9403	0.9640 (89)
MIT 2	18.5496	18.7230	19.0200	19.4205	19.7567	19.9805	20.0464	20.0414	19.9118	19.5079	18.9807	18.5267 (90)
Living area fraction	18.6993	18.8730	19.1708	19.5722	19.9130	20.1425	20.2139	20.2074	20.0704	19.6589	19.1293	18.6750 (91)
MIT	18.6993	18.8730	19.1708	19.5722	19.9130	20.1425	20.2139	20.2074	20.0704	19.6589	19.1293	18.6750 (92)
Temperature adjustment	18.5493	18.7230	19.0208	19.4222	19.7630	19.9925	20.0639	20.0574	19.9204	19.5089	18.9793	18.5250 (93)
adjusted MIT	18.5493	18.7230	19.0208	19.4222	19.7630	19.9925	20.0639	20.0574	19.9204	19.5089	18.9793	18.5250 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9477	0.9325	0.9040	0.8457	0.7431	0.5792	0.4147	0.4516	0.6710	0.8513	0.9262	0.9531	(94)
Useful gains	652.8174	690.3636	703.6800	686.5171	615.0348	464.1833	317.7320	331.3050	473.1674	573.5294	607.8347	630.0389	(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	1401.9561	1355.9191	1224.5552	1014.7620	775.5423	512.2813	329.0615	346.6405	555.5881	856.9048	1148.7300	1392.9536	(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	557.3592	447.2533	387.5311	236.3363	119.4176	0.0000	0.0000	0.0000	0.0000	210.8313	389.4446	567.6085	(98)
Space heating												2915.7820	(98)
Space heating per m2												(98) / (4) =	31.3458 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3221.8586 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	557.3592	447.2533	387.5311	236.3363	119.4176	0.0000	0.0000	0.0000	0.0000	210.8313	389.4446	567.6085	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	615.8665	494.2025	428.2112	261.1451	131.9532	0.0000	0.0000	0.0000	0.0000	232.9628	430.3256	627.1918	(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	173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933	(64)
Efficiency of water heater (217)m	89.7185	89.6649	89.5486	89.2866	88.7756	87.3000	87.3000	87.3000	87.3000	89.1706	89.5610	87.3000	(216)
Fuel for water heating, kWh/month	193.6349	169.9093	176.6351	155.9575	151.6343	134.7537	126.5505	142.8310	143.8320	162.0852	174.1943	187.9668	(219)
Water heating fuel used												1919.9845	(219)
Annual totals kWh/year													
Space heating fuel - main system												3221.8586	(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)												455.8311	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.68 * 1029 * 1.00) =										-2206.5763		-2206.5763	(233)
Total delivered energy for all uses												3466.0978	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3221.8586	3.4800	112.1207 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1919.9845	3.4800	66.8155 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	455.8311	13.1900	60.1241 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-2206.5763	13.1900	-291.0474 (252)
Total energy cost			77.9053 (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] =	0.2371 (257)
SAP value		96.6929
SAP rating (Section 12)		97 (258)
SAP band		A

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	3221.8586	0.2160	695.9214 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1919.9845	0.2160	414.7167 (264)
Space and water heating			1110.6381 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.8311	0.5190	236.5763 (268)
Energy saving/generation technologies			
PV Unit	-2206.5763	0.5190	-1145.2131 (269)
Total kg/year			240.9263 (272)
CO2 emissions per m2			2.5900 (273)
EI value			97.6609
EI rating			98 (274)
EI band			A

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8872 = 3.922$, stars = 4
Water heating environmental impact	$0.216 / 0.8872 = 0.2435$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1327 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3832 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3545 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.0000	5.6000	5.6000	5.0000	5.0000	4.4000	4.4000	4.3000	4.7000	5.4000	5.5000	5.9000 (22)
Wind factor	1.5000	1.4000	1.4000	1.2500	1.2500	1.1000	1.1000	1.0750	1.1750	1.3500	1.3750	1.4750 (22a)
Adj infilt rate	0.5317	0.4963	0.4963	0.4431	0.4431	0.3899	0.3899	0.3811	0.4165	0.4785	0.4874	0.5229 (22b)
Effective ac	0.6414	0.6231	0.6231	0.5982	0.5982	0.5760	0.5760	0.5726	0.5867	0.6145	0.6188	0.6367 (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
Windows (Uw = 1.30)			8.0000	1.2357	9.8859		(27)
Solid Door			4.2000	1.2000	5.0400		(26)
Flr - Ground			46.5070	0.2100	9.7665	75.6000	3515.9292 (28a)
Wl - Brick	94.2940	12.2040	82.0900	0.2400	19.7016	38.9400	3196.5846 (29a)
Rf - Ins Joist	46.5070		46.5070	0.1000	4.6507	5.8200	270.6707 (30)
Total net area of external elements Aum(A, m ²)			187.3040				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.0447		(33)
Party Wall			42.0580	0.0000	0.0000	54.0300	2272.3937 (32)
Ground Floor Block			12.4255			54.0300	671.3493 (32c)
Ground Floor Stud			68.0169			5.8200	395.8583 (32c)
1st Floor Stud			109.3269			5.8200	636.2825 (32c)
Internal Floor			46.5000			18.0000	837.0000 (32d)
Internal Ceiling			46.5000			5.8200	270.6300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12066.6985 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							129.7215 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4280 (36)
Total fabric heat loss							(33) + (36) = 53.4727 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	47.8410	46.4819	46.4819	44.6190	44.6190	42.9670	42.9670	42.7122	43.7667	45.8375	46.1568	47.4924 (38)
Heat transfer coeff	101.3137	99.9546	99.9546	98.0917	98.0917	96.4398	96.4398	96.1849	97.2394	99.3102	99.6295	100.9652 (39)
Average = Sum(39)m / 12 =												98.6346 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0892	1.0745	1.0745	1.0545	1.0545	1.0368	1.0368	1.0340	1.0454	1.0676	1.0711	1.0854 (40)
HLP (average)												1.0604 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m = 1533.8973 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6940	13.2584	14.6451	14.1170	14.5470	14.0310	14.4696	14.5198	14.0778	14.6045	14.1838	(61)
Total heat required for water heating calculated for each month												
173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933	(64)
Heat gains from water heating, kWh/month												
56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032	54.8795	(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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.5276	57.3129	46.6099	35.2867	26.3772	22.2688	24.0622	31.2770	41.9799	53.3031	62.2126	66.3210	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	76.0104	73.7533	69.0655	62.6885	58.5472	52.7191	47.7693	54.1156	56.3737	62.9733	70.4212	73.7628	(72)
Total internal gains	615.4520	609.7673	584.8330	546.8156	508.1182	474.0773	454.8178	464.5917	487.0962	525.3362	567.3402	598.8946	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
Northeast				3.9540	15.4538	0.7600		0.7200			0.7700	23.1714 (75)	
Southwest				4.0460	47.2368	0.7600		0.7200			0.7700	72.4746 (79)	
Solar gains	95.6459	144.3401	214.9621	300.0850	345.1881	378.1489	332.7248	306.1867	249.3189	166.8480	111.7666	77.8983	(83)
Total gains	711.0979	754.1074	799.7950	846.9006	853.3063	852.2262	787.5427	770.7784	736.4151	692.1842	679.1069	676.7928	(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	33.0840	33.5338	33.5338	34.1707	34.1707	34.7560	34.7560	34.8481	34.4702	33.7514	33.6433	33.1982
alpha	3.2056	3.2356	3.2356	3.2780	3.2780	3.3171	3.3171	3.3232	3.2980	3.2501	3.2429	3.2132
util living area	0.9506	0.9392	0.9158	0.8670	0.7832	0.6399	0.5416	0.5408	0.6991	0.8580	0.9241	0.9539 (86)
MIT	19.6170	19.7485	19.9721	20.3069	20.6240	20.8627	20.9386	20.9405	20.8193	20.4661	20.0526	19.6240 (87)
Th 2	20.0097	20.0217	20.0217	20.0381	20.0381	20.0528	20.0528	20.0551	20.0457	20.0274	20.0245	20.0128 (88)
util rest of house	0.9414	0.9282	0.9003	0.8420	0.7401	0.5706	0.4503	0.4478	0.6292	0.8238	0.9077	0.9451 (89)
MIT 2	18.7823	18.9192	19.1359	19.4678	19.7586	19.9698	20.0243	20.0280	19.9345	19.6152	19.2207	18.7924 (90)
Living area fraction	18.9362	19.0721	19.2901	19.6225	19.9181	20.1344	20.1929	20.1962	20.0976	19.7721	19.3740	18.9457 (91)
MIT	18.9362	19.0721	19.2901	19.6225	19.9181	20.1344	20.1929	20.1962	20.0976	19.7721	19.3740	18.9457 (92)
Temperature adjustment	18.7862	18.9221	19.1401	19.4725	19.7681	19.9844	20.0429	20.0462	19.9476	19.6221	19.2240	18.7957 (93)
adjusted MIT	18.7862	18.9221	19.1401	19.4725	19.7681	19.9844	20.0429	20.0462	19.9476	19.6221	19.2240	18.7957 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9270	0.9126	0.8832	0.8248	0.7264	0.5652	0.4493	0.4468	0.6212	0.8068	0.8910	0.9311	(94)
Useful gains	659.1547	688.2198	706.3465	698.4918	619.8687	481.6547	353.8604	344.4031	457.4846	558.4260	605.0657	630.1848	(95)
Ext temp.	6.1000	6.4000	7.5000	9.3000	11.9000	14.5000	16.2000	16.3000	14.6000	11.8000	9.0000	6.4000	(96)
Heat loss rate W	1285.2888	1251.6449	1163.4808	997.8361	771.8002	528.9174	370.6074	360.3306	519.9989	776.8097	1018.6166	1251.5374	(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	465.8437	378.6217	340.1080	215.5279	113.0370	0.0000	0.0000	0.0000	0.0000	162.4775	297.7567	462.2863	(98)
Space heating												2435.6587	(98)
Space heating per m2											(98) / (4) =	26.1842	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2691.3356	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	465.8437	378.6217	340.1080	215.5279	113.0370	0.0000	0.0000	0.0000	0.0000	162.4775	297.7567	462.2863	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	514.7445	418.3665	375.8099	238.1524	124.9028	0.0000	0.0000	0.0000	0.0000	179.5331	329.0129	510.8136	(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	173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933	(64)
Efficiency of water heater (217)m	89.6078	89.5581	89.4591	89.2164	88.7321	87.3000	87.3000	87.3000	87.3000	88.9648	89.3737	87.3000	(216)
Fuel for water heating, kWh/month	193.8741	170.1120	176.8118	156.0801	151.7088	134.7537	126.5505	142.8310	143.8320	162.4602	174.5595	188.2281	(219)
Water heating fuel used												1921.8017	(219)
Annual totals kWh/year													
Space heating fuel - main system												2691.3356	(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)												455.8311	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.68 * 1169 * 1.00) =										-2506.1908		-2506.1908	(233)
Total delivered energy for all uses												2637.7776	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2691.3356	9.7400	262.1361 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1921.8017	9.7400	187.1835 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	455.8311	36.8500	167.9738 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-2506.1908	36.8500	-923.5313 (252)
Total energy cost			-174.6005 (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	2691.3356	0.2160	581.3285 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1921.8017	0.2160	415.1092 (264)
Space and water heating			996.4377 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.8311	0.5190	236.5763 (268)
Energy saving/generation technologies			
PV Unit	-2506.1908	0.5190	-1300.7130 (269)
Total kg/year			-28.7740 (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	2691.3356	1.2200	3283.4294 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1921.8017	1.2200	2344.5981 (264)
Space and water heating			5628.0275 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	455.8311	3.0700	1399.4015 (268)
Energy saving/generation technologies			
PV Unit	-2506.1908	3.0700	-7694.0059 (269)
Primary energy kWh/year			-436.3269 (272)
Primary energy kWh/m2/year			-4.6907 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 97
Current environmental impact rating: A 98

(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	+ 1.2	-£ 80	-193 kg (671.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£80 2.08 kg/m²	A 98	A 99
Total Savings	£80 2.08 kg/m²		

Potential energy efficiency rating: A 98
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 514 TEST (30 Mar 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, South West England):

	Current	Potential	Saving
Electricity	£196	£214	-£18
Mains gas	£553	£455	£99
Space heating	£394	£394	£0
Water heating	£187	£107	£80
Lighting	£168	£168	£0
Generated (PV)	-£924	-£924	£0
Total cost of fuels	-£175	-£255	£81
Total cost of uses	-£175	-£255	£80
Delivered energy	28 kWh/m²	18 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.0 tonnes	-0.2 tonnes	0.2 tonnes
CO2 emissions per m²	0 kg/m²	-2 kg/m²	2 kg/m²
Primary energy	-5 kWh/m²	-16 kWh/m²	12 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1327 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3832 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3545 (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	0.4520	0.4431	0.4342	0.3899	0.3811	0.3368	0.3368	0.3279	0.3545	0.3811	0.3988	0.4165 (22b)
Effective ac	0.6021	0.5982	0.5943	0.5760	0.5726	0.5567	0.5567	0.5538	0.5628	0.5726	0.5795	0.5867 (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
Windows (Uw = 1.30)			8.0000	1.2357	9.8859		(27)
Solid Door			4.2000	1.2000	5.0400		(26)
Flr - Ground			46.5070	0.2100	9.7665	75.6000	3515.9292 (28a)
Wl - Brick	94.2940	12.2040	82.0900	0.2400	19.7016	38.9400	3196.5846 (29a)
Rf - Ins Joist	46.5070		46.5070	0.1000	4.6507	5.8200	270.6707 (30)
Total net area of external elements Aum(A, m ²)			187.3040				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.0447		(33)
Party Wall			42.0580	0.0000	0.0000	54.0300	2272.3937 (32)
Ground Floor Block			12.4255			54.0300	671.3493 (32c)
Ground Floor Stud			68.0169			5.8200	395.8583 (32c)
1st Floor Stud			109.3269			5.8200	636.2825 (32c)
Internal Floor			46.5000			18.0000	837.0000 (32d)
Internal Ceiling			46.5000			5.8200	270.6300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12066.6985 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							129.7215 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4280 (36)
Total fabric heat loss							(33) + (36) = 53.4727 (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	44.9148	44.6190	44.3290	42.9670	42.7122	41.5259	41.5259	41.3062	41.9829	42.7122	43.2277	43.7667 (38)
Heat transfer coeff	98.3876	98.0917	97.8018	96.4398	96.1849	94.9987	94.9987	94.7790	95.4556	96.1849	96.7004	97.2394 (39)
Average = Sum(39)m / 12 =												96.4385 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0577	1.0545	1.0514	1.0368	1.0340	1.0213	1.0213	1.0189	1.0262	1.0340	1.0396	1.0454 (40)
HLP (average)												1.0368 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1533.8973 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6940	13.2584	14.6451	14.1170	14.5470	14.0310	14.4696	14.5198	14.0778	14.6045	14.1838 (61)
Total heat required for water heating calculated for each month											
173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-25.0098	-41.7341	-71.0780	-95.2585	-117.6839	-115.7020	-114.1730	-99.7535	-78.1270	-53.3515	-29.6652
Solar input (sum of months) = Sum(63)m =											
Output from w/h	148.7166	110.6149	87.0962	43.9906	16.9304	1.9380	0.0000	24.9379	47.4383	91.1808	126.3450
Heat gains from water heating, kWh/month	56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032
56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032	54.8795 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.5276	57.3129	46.6099	35.2867	26.3772	22.2688	24.0622	31.2770	41.9799	53.3031	62.2126	66.3210	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	76.0104	73.7533	69.0655	62.6885	58.5472	52.7191	47.7693	54.1156	56.3737	62.9733	70.4212	73.7628	(72)
Total internal gains	615.4520	609.7673	584.8330	546.8156	508.1182	474.0773	454.8178	464.5917	487.0962	525.3362	567.3402	598.8946	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				3.9540	11.2829	0.7600		0.7200		0.7700		16.9176 (75)	
Southwest				4.0460	36.7938	0.7600		0.7200		0.7700		56.4521 (79)	

Solar gains	73.3697	130.5951	193.6119	264.9127	319.5597	327.2934	311.3657	269.0609	218.0616	148.3598	88.9033	62.1270 (83)	
Total gains	688.8217	740.3624	778.4448	811.7283	827.6779	801.3707	766.1835	733.6526	705.1578	673.6960	656.2436	661.0216 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.0679	34.1707	34.2720	34.7560	34.8481	35.2832	35.2832	35.3650	35.1143	34.8481	34.6623	34.4702	
alpha	3.2712	3.2780	3.2848	3.3171	3.3232	3.3522	3.3522	3.3577	3.3410	3.3232	3.3108	3.2980	
util living area	0.9654	0.9539	0.9319	0.8846	0.7976	0.6550	0.5105	0.5474	0.7427	0.8928	0.9501	0.9692	(86)
MIT	19.3619	19.5364	19.8377	20.2435	20.6047	20.8592	20.9546	20.9417	20.7719	20.3272	19.7864	19.3309	(87)
Th 2	20.0355	20.0381	20.0407	20.0528	20.0551	20.0656	20.0656	20.0676	20.0616	20.0551	20.0505	20.0457	(88)
util rest of house	0.9595	0.9460	0.9198	0.8629	0.7572	0.5852	0.4149	0.4527	0.6814	0.8684	0.9403	0.9640	(89)
MIT 2	18.5496	18.7230	19.0200	19.4205	19.7567	19.9805	20.0464	20.0414	19.9118	19.5079	18.9807	18.5267	(90)
Living area fraction	18.6993	18.8730	19.1708	19.5722	19.9130	20.1425	20.2139	20.2074	20.0704	19.6589	19.1293	18.6750	(91)
MIT	18.6993	18.8730	19.1708	19.5722	19.9130	20.1425	20.2139	20.2074	20.0704	19.6589	19.1293	18.6750	(92)
Temperature adjustment	18.5493	18.7230	19.0208	19.4222	19.7630	19.9925	20.0639	20.0574	19.9204	19.5089	18.9793	18.5250	(93)
adjusted MIT	18.5493	18.7230	19.0208	19.4222	19.7630	19.9925	20.0639	20.0574	19.9204	19.5089	18.9793	18.5250	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	0.9477	0.9325	0.9040	0.8457	0.7431	0.5792	0.4147	0.4516	0.6710	0.8513	0.9262	0.9531	(94)
Useful gains	652.8174	690.3636	703.6800	686.5171	615.0348	464.1833	317.7320	331.3050	473.1674	573.5294	607.8347	630.0389	(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	1401.9561	1355.9191	1224.5552	1014.7620	775.5423	512.2813	329.0615	346.6405	555.5881	856.9048	1148.7300	1392.9536	(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	557.3592	447.2533	387.5311	236.3363	119.4176	0.0000	0.0000	0.0000	0.0000	210.8313	389.4446	567.6085	(98)
Space heating												2915.7820	(98)
Space heating per m2												31.3458	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3221.8586	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	557.3592	447.2533	387.5311	236.3363	119.4176	0.0000	0.0000	0.0000	0.0000	210.8313	389.4446	567.6085	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	615.8665	494.2025	428.2112	261.1451	131.9532	0.0000	0.0000	0.0000	0.0000	232.9628	430.3256	627.1918	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	148.7166	110.6149	87.0962	43.9906	16.9304	1.9380	0.0000	24.9379	47.4383	91.1808	126.3450	147.7644	(64)	
Efficiency of water heater	89.8067	89.8470	89.8953	89.9824	90.0900	87.3000	87.3000	87.3000	87.3000	89.5094	89.6946	89.8199	(217)	
Fuel for water heating, kWh/month	165.5964	123.1148	96.8863	48.8880	18.7928	2.2199	0.0000	28.5658	54.3394	101.8673	140.8613	164.5117	(219)	
Water heating fuel used												945.6436	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3221.8586	(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)													455.8311	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.68 * 1029 * 1.00) =										-2206.5763		-2206.5763	(233)	
Total delivered energy for all uses													2541.7569	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3221.8586	3.4800	112.1207	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	945.6436	3.4800	32.9084	(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	455.8311	13.1900	60.1241	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-2206.5763	13.1900	-291.0474	(252)
Total energy cost			50.5933	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			0.1540	(257)
SAP value			97.8523	
SAP rating (Section 12)			98	(258)
SAP band			A	

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3221.8586	0.2160	695.9214 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	945.6436	0.2160	204.2590 (264)
Space and water heating			900.1805 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	455.8311	0.5190	236.5763 (268)
Energy saving/generation technologies			
PV Unit	-2206.5763	0.5190	-1145.2131 (269)
Total kg/year			56.4187 (272)
CO2 emissions per m2			0.6100 (273)
EI value			99.4522
EI rating			99 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	46.5100 (1b)	x 2.3300 (2b)	= 108.3683 (1b) - (3b)
First floor	46.5100 (1c)	x 2.5300 (2c)	= 117.6703 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 226.0386 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1327 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3832 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3545 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.0000	5.6000	5.6000	5.0000	5.0000	4.4000	4.4000	4.3000	4.7000	5.4000	5.5000	5.9000 (22)
Wind factor	1.5000	1.4000	1.4000	1.2500	1.2500	1.1000	1.1000	1.0750	1.1750	1.3500	1.3750	1.4750 (22a)
Adj infilt rate	0.5317	0.4963	0.4963	0.4431	0.4431	0.3899	0.3899	0.3811	0.4165	0.4785	0.4874	0.5229 (22b)
Effective ac	0.6414	0.6231	0.6231	0.5982	0.5982	0.5760	0.5760	0.5726	0.5867	0.6145	0.6188	0.6367 (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
Windows (Uw = 1.30)			8.0000	1.2357	9.8859		(27)
Solid Door			4.2000	1.2000	5.0400		(26)
Flr - Ground			46.5070	0.2100	9.7665	75.6000	3515.9292 (28a)
Wl - Brick	94.2940	12.2040	82.0900	0.2400	19.7016	38.9400	3196.5846 (29a)
Rf - Ins Joist	46.5070		46.5070	0.1000	4.6507	5.8200	270.6707 (30)
Total net area of external elements Aum(A, m ²)			187.3040				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.0447		(33)
Party Wall			42.0580	0.0000	0.0000	54.0300	2272.3937 (32)
Ground Floor Block			12.4255			54.0300	671.3493 (32c)
Ground Floor Stud			68.0169			5.8200	395.8583 (32c)
1st Floor Stud			109.3269			5.8200	636.2825 (32c)
Internal Floor			46.5000			18.0000	837.0000 (32d)
Internal Ceiling			46.5000			5.8200	270.6300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12066.6985 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							129.7215 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4280 (36)
Total fabric heat loss							(33) + (36) = 53.4727 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	47.8410	46.4819	46.4819	44.6190	44.6190	42.9670	42.9670	42.7122	43.7667	45.8375	46.1568	47.4924 (38)
Heat transfer coeff	101.3137	99.9546	99.9546	98.0917	98.0917	96.4398	96.4398	96.1849	97.2394	99.3102	99.6295	100.9652 (39)
Average = Sum(39)m / 12 =												98.6346 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0892	1.0745	1.0745	1.0545	1.0545	1.0368	1.0368	1.0340	1.0454	1.0676	1.0711	1.0854 (40)
HLP (average)												1.0604 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	Total = Sum (45)m = 1533.8973 (45)											
Distribution loss (46)m = 0.15 x (45)m												
	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6940	13.2584	14.6451	14.1170	14.5470	14.0310	14.4696	14.5198	14.0778	14.6045	14.1838	14.6790 (61)
Total heat required for water heating calculated for each month	173.7263	152.3490	158.1742	139.2491	134.6143	117.6400	110.4786	124.6914	125.5653	144.5324	156.0102	168.6933 (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												1220.6462 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2050.6856 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3369 (H8)
Utilisation factor												0.5267 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.4900 (H14)
Volume ratio Veff/V												0.7693 (H15)
Solar storage volume factor												0.9475 (H16)
Solar input	-30.5351	-43.0841	-73.2535	-99.4252	-116.6614	-122.5577	-111.8944	-104.3839	-82.6599	-55.9281	-34.9072	-899.8793 (H17)
Solar input (sum of months) = Sum (63)m =												-899.8793 (63)
Output from w/h	143.1912	109.2650	84.9207	39.8239	17.9529	0.0000	0.0000	20.3076	42.9054	88.6043	121.1030	144.1044 (64)
Total per year (kWh/year) = Sum (64)m =												812.1785 (64)
Heat gains from water heating, kWh/month	56.5518	49.5622	51.3847	45.1357	43.5591	37.9577	35.5404	40.2620	40.5890	46.8521	50.7032	54.8795 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.5276	57.3129	46.6099	35.2867	26.3772	22.2688	24.0622	31.2770	41.9799	53.3031	62.2126	66.3210	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	76.0104	73.7533	69.0655	62.6885	58.5472	52.7191	47.7693	54.1156	56.3737	62.9733	70.4212	73.7628	(72)
Total internal gains	615.4520	609.7673	584.8330	546.8156	508.1182	474.0773	454.8178	464.5917	487.0962	525.3362	567.3402	598.8946	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF			Access factor Table 6d	Gains W	
Northeast					3.9540	15.4538	0.7600		0.7200			0.7700	23.1714 (75)	
Southwest					4.0460	47.2368	0.7600		0.7200			0.7700	72.4746 (79)	

Solar gains	95.6459	144.3401	214.9621	300.0850	345.1881	378.1489	332.7248	306.1867	249.3189	166.8480	111.7666		77.8983	(83)
Total gains	711.0979	754.1074	799.7950	846.9006	853.3063	852.2262	787.5427	770.7784	736.4151	692.1842	679.1069		676.7928	(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	33.0840	33.5338	33.5338	34.1707	34.1707	34.7560	34.7560	34.8481	34.4702	33.7514	33.6433	33.1982	
alpha	3.2056	3.2356	3.2356	3.2780	3.2780	3.3171	3.3171	3.3232	3.2980	3.2501	3.2429	3.2132	
util living area	0.9506	0.9392	0.9158	0.8670	0.7832	0.6399	0.5416	0.5408	0.6991	0.8580	0.9241	0.9539	(86)
MIT	19.6170	19.7485	19.9721	20.3069	20.6240	20.8627	20.9386	20.9405	20.8193	20.4661	20.0526	19.6240	(87)
Th 2	20.0097	20.0217	20.0217	20.0381	20.0381	20.0528	20.0528	20.0551	20.0457	20.0274	20.0245	20.0128	(88)
util rest of house	0.9414	0.9282	0.9003	0.8420	0.7401	0.5706	0.4503	0.4478	0.6292	0.8238	0.9077	0.9451	(89)
MIT 2	18.7823	18.9192	19.1359	19.4678	19.7586	19.9698	20.0243	20.0280	19.9345	19.6152	19.2207	18.7924	(90)
Living area fraction	18.9362	19.0721	19.2901	19.6225	19.9181	20.1344	20.1929	20.1962	20.0976	19.7721	19.3740	18.9457	(91)
MIT	18.9362	19.0721	19.2901	19.6225	19.9181	20.1344	20.1929	20.1962	20.0976	19.7721	19.3740	18.9457	(92)
Temperature adjustment	18.7862	18.9221	19.1401	19.4725	19.7681	19.9844	20.0429	20.0462	19.9476	19.6221	19.2240	18.7957	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	0.9270	0.9126	0.8832	0.8248	0.7264	0.5652	0.4493	0.4468	0.6212	0.8068	0.8910	0.9311	(94)
Useful gains	659.1547	688.2198	706.3465	698.4918	619.8687	481.6547	353.8604	344.4031	457.4846	558.4260	605.0657	630.1848	(95)
Ext temp.	6.1000	6.4000	7.5000	9.3000	11.9000	14.5000	16.2000	16.3000	14.6000	11.8000	9.0000	6.4000	(96)
Heat loss rate W	1285.2888	1251.6449	1163.4808	997.8361	771.8002	528.9174	370.6074	360.3306	519.9989	776.8097	1018.6166	1251.5374	(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	465.8437	378.6217	340.1080	215.5279	113.0370	0.0000	0.0000	0.0000	0.0000	162.4775	297.7567	462.2863	(98)
Space heating												2435.6587	(98)
Space heating per m2											(98) / (4) =	26.1842	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2691.3356	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	465.8437	378.6217	340.1080	215.5279	113.0370	0.0000	0.0000	0.0000	0.0000	162.4775	297.7567	462.2863	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	514.7445	418.3665	375.8099	238.1524	124.9028	0.0000	0.0000	0.0000	0.0000	179.5331	329.0129	510.8136	(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	143.1912	109.2650	84.9207	39.8239	17.9529	0.0000	0.0000	20.3076	42.9054	88.6043	121.1030	144.1044	(64)	
Efficiency of water heater	89.7267	89.7631	89.8420	89.9856	90.0476	87.3000	87.3000	87.3000	87.3000	89.3443	89.5509	89.7185	(217)	
Fuel for water heating, kWh/month	159.5859	121.7259	94.5223	44.2559	19.9372	0.0000	0.0000	23.2618	49.1470	99.1718	135.2337	160.6184	(219)	
Water heating fuel used												907.4599	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2691.3356	(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)												455.8311	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.68 * 1169 * 1.00) =										-2506.1908		-2506.1908	(233)	
Total delivered energy for all uses												1673.4357	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2691.3356	9.7400	262.1361	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	907.4599	9.7400	88.3866	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	455.8311	36.8500	167.9738	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-2506.1908	36.8500	-923.5313	(252)
Total energy cost			-254.9724	(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	2691.3356	0.2160	581.3285	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	907.4599	0.2160	196.0113	(264)
Space and water heating			777.3398	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	455.8311	0.5190	236.5763	(268)
Energy saving/generation technologies				
PV Unit	-2506.1908	0.5190	-1300.7130	(269)
Total kg/year			-221.9219	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	2691.3356	1.2200	3283.4294 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	907.4599	1.2200	1107.1010 (264)
Space and water heating			4390.5305 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	455.8311	3.0700	1399.4015 (268)
Energy saving/generation technologies			
PV Unit	-2506.1908	3.0700	-7694.0059 (269)
Primary energy kWh/year			-1520.3239 (272)
Primary energy kWh/m2/year			-16.3441 (273)

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	175 - PRJ010636				Issued on Date	06/04/2023
Assessment Reference	175 S			Prop Type Ref	Sutherland	
Property	Plot 175					
SAP Rating	97 A	DER	4.32	TER	17.69	
Environmental	98 A	% DER<TER	75.58			
CO ₂ Emissions (t/year)	-0.03	DFEE	41.92	TFEE	49.64	
General Requirements Compliance	Pass	% DFEE<TFEE	15.54			
Assessor Details	Chris Nicholls , Tel: ,				Assessor ID	U903-0001
Client						

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.69	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	4.32	kgCO ₂ /m ²	Pass
	-13.37 (-75.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.64	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	41.92	kWh/m ² /yr	
	-7.7 (-15.5%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.21 (max. 0.25)	0.21 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.27 (max. 2.00)	1.30 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.01 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (South West England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North East

3.95 m², No overhang

Windows facing South West

4.05 m², No overhang

Air change rate

3.87 ach

Blinds/curtains

Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.01 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Thermal bridging γ -value

0.024

W/m²K

Photovoltaic array

2.68

kW