

SAP 2009 input data (new dwelling as built)

Filename: EW-1a-detached

1a-detached

BD8 7LL

Country: England & Wales
 Region: East Pennines
 Postcode: BD8 7LL
 UPRN: 0000000000
 RRN: (not assigned)
 Date of assessment: 26 August 2011
 Date of certificate: 07 June 2012
 Assessment type: New dwelling as built
 Transaction type: New dwelling
 Related party disclosure: No related party

Property description

Dwelling type: House
 Detachment: Detached
 Year completed: 2011

	<u>Floor area</u>	<u>Storey height</u>
Ground floor	50.00 m ²	2.40 m
First floor	50.00 m ²	2.60 m
Living area:	30.00 m ²	(fraction 0.300)

Front of dwelling faces: East

Opening types

<u>Name</u>	<u>Source</u>	<u>Type</u>	<u>Glazing</u>	<u>Argon</u>	<u>Frame</u>
Doors	SAP	Solid door			
Windows (1)	manu.	Window	Double		

Opening types (continued)

<u>Name</u>	<u>Gap</u>	<u>Frame Factor</u>	<u>g-value</u>	<u>U-value</u>	<u>Description</u>
Doors				3.00	
Windows (1)		0.70	0.72	1.20	Data from Manufacturer ABC

Openings

<u>Name</u>	<u>Type-Name</u>	<u>Location</u>	<u>Orient.</u>	<u>Width</u>	<u>Height</u>
1	Doors	Walls (1)	n/a	2.00	1.00
2	Windows (1)	Walls (1)	East	23.00	1.00

Overshading: Average

	<u>Gross area</u>	<u>Openings</u>	<u>Net area</u>	<u>U-value</u>	<u>κ-value</u>	<u>Description</u>
Doors				2.00	3.00	
Windows (1)			23.00	1.20		
Ground floor			50.00	0.20	80	
Walls (1)	150.00	25.00	125.00	0.18	60	
Roof (1)	50.00		50.00	0.13	9	
Internal wall (1)			200.00		75	
Internal floor level 1 from below			50.00		9	
Internal floor level 1 from above			50.00		18	

Thermal bridges:	User-defined y-value y = 0.080 Reference: Thermal bridging for 1a.doc
Thermal mass:	Calculated from κ values
Pressure test:	Yes (measured in this dwelling)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of intermittent fans:	3
Number of passive stacks:	0
Number of sides sheltered:	2
q50 measured in this dwelling:	4.00
Main heating system:	Boiler system with radiators or underfloor Fuel: Mains gas Manufacturer's data: Brand/Model: Combi - no store or keep-hot, room-sealed flue, fan-assisted SEDBUK(2005) 90.0%, condensing, modulating burner
control	Radiators Central heating pump in heated space
Main heating controls:	2106 Programmer, room thermostat and TRVs Boiler interlock: Yes
Secondary heating:	None
Space cooling system:	None
Water heating:	901 From main system No hot water cylinder Solar panel: No
Water use <= 125 litres/person/day	No
Electricity tariff:	Standard tariff
Conservatory:	No
Photovoltaics:	None
Terrain type:	Rural
Wind turbine:	No
Total fixed lighting outlets:	10
Low energy fixed lighting outlets:	3 (= 30% of total outlets)
EPC language	English

Results summary -- New dwelling as built -- Worksheet version 9.90 -- bsap2009 v 5.34q

Regulations: Approved Document L1A, 2010 Edition

SAP 2009 = C 80 EI 2009 = B 82 DER = 20.87 TER = 19.49 FEE = 55.1

Heat demand kWh: space 4088 water 2240

PCDF revision number: 322 (03 Apr 2012)

External Definitions revision number: 3.0 (01 Mar 2011)

Applicable recommendations: Low energy lighting [E]

Solar water heating [N]

Solar photovoltaic (PV) panels [U]

Wind turbine [V]

SAP 2009 input data (new dwelling as built)

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Filename: EW-1a-detached.bsp (File saved: 29 Aug 2011 11:37)

1a-detached - with improvements

BD8 7LL

With improvements:

E	Low energy lighting
N	Solar water heating
U	Solar photovoltaic (PV) panels
V	Wind turbine

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Property description

Dwelling type: House
 Detachment: Detached
 Year completed: 2011

	<u>Floor area</u>	<u>Storey height</u>
Ground floor	50.00 m ²	2.40 m
First floor	50.00 m ²	2.60 m

Living area: 30.00 m² (fraction 0.300)

Front of dwelling faces: East

Opening types

<u>Name</u>	<u>Source</u>	<u>Type</u>	<u>Glazing</u>	<u>Argon</u>	<u>Frame</u>
Doors	SAP	Solid door			
Windows (1)	manu.	Window	Double		

Opening types (continued)

<u>Name</u>	<u>Gap</u>	<u>Frame Factor</u>	<u>g-value</u>	<u>U-value</u>	<u>Description</u>
Doors				3.00	
Windows (1)		0.70	0.72	1.20	Data from Manufacturer ABC

Openings

<u>Name</u>	<u>Type-Name</u>	<u>Location</u>	<u>Orient.</u>	<u>Width</u>	<u>Height</u>
1	Doors	Walls (1)	n/a	2.00	1.00
2	Windows (1)	Walls (1)	East	23.00	1.00

Overshading: Average

	<u>Gross area</u>	<u>Openings</u>	<u>Net area</u>	<u>U-value</u>	<u>κ-value</u>	<u>Description</u>
Doors			2.00		3.00	
Windows (1)			23.00	1.20		
Ground floor			50.00	0.20	80	
Walls (1)	150.00	25.00	125.00	0.18	60	

Roof (1)	50.00	50.00	0.13	9
Internal wall (1)		200.00		75
Internal floor level 1 from below		50.00		9
Internal floor level 1 from above		50.00		18

Thermal bridges: User-defined y-value
y = 0.080
Reference: Thermal bridging for 1a.doc

Thermal mass: Calculated from κ values

Pressure test: Yes (measured in this dwelling)
Ventilation: Natural ventilation (extract fans)
Number of chimneys: 0
Number of open flues: 0
Number of intermittent fans: 3
Number of passive stacks: 0
Number of sides sheltered: 2
q50 measured in this dwelling: 4.00

Main heating system: Boiler system with radiators or underfloor
Fuel: Mains gas
Specified data:
Combi - no store or keep-hot, room-sealed flue, fan-assisted
SEDBUK(2005) 90.0%, condensing, modulating burner

control

Radiators
Central heating pump in heated space
Main heating controls: 2106 Programmer, room thermostat and TRVs
Boiler interlock: Yes

Secondary heating: None

Space cooling system: None

Water heating: 901 From main system
No hot water cylinder
Solar panel: Yes - aperture area: 3.00 m²
evacuated tube - declared values
collector zero-loss efficiency: 0.70
collector heat loss coefficient: 1.80
orientation: South, 30° pitch
overshading: Modest
dedicated solar store volume: 75 litres (separate store)
electrically powered pump

Water use <= 125 litres/person/day No
Electricity tariff: Standard tariff
Conservatory: No
Photovoltaics: Peak kW: 2.50
pitch: 30°, orientation South
overshading: Modest

Terrain type: Rural
Wind turbine: Number of turbines: 1
rotor diameter: 2.00
hub height above building: 2.00

Total fixed lighting outlets: 10

Low energy fixed lighting outlets:	10 (= 100% of total outlets)
EPC language	English

Results summary -- Improved dwelling -- Worksheet version 9.90 -- bsap2009 v 5.34q
SAP 2009 = A 95 EI 2009 = A 97

SAP 2009 WORKSHEET FOR NEW DWELLING AS BUILT (Version 9.90, March 2010)**CALCULATION OF FABRIC ENERGY EFFICIENCY**

calculated by program bsap2009 version 5.34q, printed on 07 Jun 2012 at 12:39

Filename: EW-1a-detached.bsp (File saved: 29 Aug 2011 11:37)

1a-detached

BD8 7LL

1. Overall dwelling dimensions

	Area (m ²)	Av. storey height (m)	Volume (m ³)	
Ground floor	50.0000	2.4000	120.0000	(1b) - (3b)
First floor	50.0000	2.6000	130.0000	(1c) - (3c)
Total floor area	100.0000			(4)
Dwelling volume (m ³)			250.0000	(5)

2. Ventilation rate

	main	sec.	other	total	<u>m³ per hour</u>								
Number of chimneys	0	+	0	+	0	=	0	×	40	0			(6a)
Number of open flues	0	+	0	+	0	=	0	×	20	0			(6b)
Number of intermittent fans				3	×	10	30						(7a)
Number of passive vents				0	×	10	0						(7b)
Number of flueless gas fires				0	×	40	0						(7c)
								<u>ach</u>					
Infiltration due to chimneys, flues and fans								0.1200					(8)
Pressure test				Yes									
q50 measured in this dwelling				4.0000									
Infiltration rate								0.3200					(18)
Number of sides sheltered				2									(19)
Shelter factor				0.8500									(20)
Infiltration rate incorporating shelter factor								0.2720					(21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.4000		5.1000		5.1000	4.5000		4.1000		3.9000		3.7000	
3.7000	4.2000		4.5000		4.8000	5.1000							
Wind factor	1.3500		1.2750		1.2750	1.1250		1.0250		0.9750		0.9250	
0.9250	1.0500		1.1250		1.2000	1.2750							
Adj infilt rate	0.3672		0.3468		0.3468	0.3060		0.2788		0.2652		0.2516	
0.2516	0.2856		0.3060		0.3264	0.3468							
Natural ventilation													
Effective ach	0.5674		0.5601		0.5601	0.5468		0.5389		0.5352		0.5317	
0.5317	0.5408		0.5468		0.5533	0.5601							(25)

3. Heat losses and heat loss parameter

Element	Gross area (m ²)		Openings (m ²)	Net area (m ²)	U-value (W/m ² K)	A × U (W/K)	kappa (kJ/m ² K)	A × kappa (kJ/K)					
Doors			2.0000		3.0000		6.0000		(26)				
Windows (U _w = 1.20)			23.0000		1.1450		26.3359		(27)				
Ground floor			50.0000		0.2000		10.0000	80.0000	4000.0000	(28a)			
Walls	150.00	25.00	125.0000	0.1800		22.5000	60.0000	7500.0000	(29a)				
Roof	50.00			50.0000		0.1300	6.5000	9.0000	450.0000	(30)			
Total area of external elements			250.0000						(31)				
Fabric heat loss					71.3359				(33)				
Internal wall			200.0000			75.0000	15000.0000		(32c)				
Internal floor level 1 from below			50.0000				9.0000	450.0000	(32e)				
Internal floor level 1 from above			50.0000				18.0000	900.0000	(32d)				
Heat capacity							28300.0000		(34)				
Thermal mass parameter							283.0000		(35)				
Thermal bridges (0.080 × total area)					20.0000				(36)				
Total fabric heat loss					91.3359				(37)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Vent loss	46.8120		46.2111		46.2111	45.1125		44.4563		44.1512		43.8612	
43.8612	44.6147		45.1125		45.6446	46.2111		(38)					
Heat transfer coeff	138.1479	137.5470	137.5470	136.4484	135.7922	135.4870	135.1971	135.1971	135.9505	136.4484	136.9805	137.5470	(39)
Heat transfer coeff (average)											136.5242		(39)
HLP	1.3815		1.3755		1.3755	1.3645		1.3579		1.3549		1.3520	
1.3520	1.3595		1.3645		1.3698	1.3755		(40)					
HLP (average)											1.3652		(40)

Days in month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements

Assumed occupancy											2.7395	(42)	
Average daily water use (litres/day)											104.4881	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily water use	114.9370	110.7574	106.5779	102.3984	98.2189	94.0393		94.0393		98.2189		102.3984	
106.5779	110.7574	114.9370	(44)										
Energy content	170.8560	149.4317	154.2001	134.4354	128.9940	111.3120	103.1469	118.3626	119.7762	139.5877	152.3709	165.4649	(45)
Energy content (annual)											1647.9384	(45)	
Distribution loss	0.0000		0.0000		0.0000		0.0000		0.0000		0.0000		0.0000
0.0000	0.0000		0.0000		0.0000		0.0000		(46)				
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		(57)				

Primary circuit loss (annual)										0.0000	(58)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)				
Heat gains (kWh)	36.3069	31.7542	32.7675	28.5675	27.4112	23.6538	21.9187				
25.1521	25.4525	29.6624	32.3788	35.1613	(65)						

5. Internal gains

(in watts)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	(66)	
Lighting	22.8518		20.2968		16.5064		12.4964		9.3412		7.8863	8.5214	
11.0764	14.8667		18.8768		22.0320		23.4869		(67)				
Appliances	256.3278	258.9876	252.2848	238.0153	220.0027	203.0733	191.7634	189.1036	195.8064	210.0759	228.0885	245.0179	(68)
Cooking	36.6976		36.6976		36.6976		36.6976		36.6976		36.6976	36.6976	
36.6976	36.6976		36.6976		36.6976		36.6976		(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	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	(71)
Water heating	48.7996		47.2533		44.0424		39.6771		36.8430		32.8525	29.4607	
33.8065	35.3506		39.8688		44.9706		47.2598		(72)				
Total internal	392.0721	390.6306	376.9266	354.2818	330.2798	307.9050	293.8384	298.0794	310.1166	332.9143	359.1839	379.8575	(73)

6. Solar gains

(calculation for January)

<u>Orientation</u>	<u>Area</u>	<u>Flux</u>	<u>g</u>	<u>FF</u>	<u>Shading</u>	<u>Gains (W)</u>						
East	0.9 ×	23.0000	19.8726	0.72	0.7000	0.77	159.6414	(76)				
					total:	159.6414	(83-1)					

Solar gains	159.6414	309.4304	494.5694	734.3182	893.4562	932.2760	904.8795	787.5364	591.2779	376.8281	198.4757	131.6884	(83)
Total gains	551.7135	700.0610	871.4959	1088.6000	1223.7360	1240.1810	1198.7179	1085.6158	901.3946	709.7424	557.6597	511.5459	(84)

7. Mean internal temperature

Living room temperature during heating periods Th 1

										<u>°C</u>		
										21.0000	(85)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.9036		57.1522		57.1522		57.6124		57.8907		58.0211	58.1456
58.1456	57.8233		57.6124		57.3885		57.1522					
alpha	4.7936		4.8101		4.8101		4.8408		4.8594		4.8681	4.8764
4.8764	4.8549		4.8408		4.8259		4.8101					
external temp.	4.5000		5.0000		6.8000		8.7000		11.7000		14.6000	16.9000
16.9000	14.3000		10.8000		7.0000		4.9000					
util living area	0.9992		0.9972		0.9885		0.9530		0.8421		0.6572	0.4566
0.5010	0.8335		0.9808		0.9982		0.9993		(86)			
MIT 1	19.5844		19.7680		20.1049		20.4736		20.8090		20.9572	20.9942

20.9914	20.8688	20.4286	19.8830	19.6034	(87)		
Th 2	19.7807	19.7853	19.7853	19.7938	19.7988	19.8012	19.8034
19.8034	19.7976	19.7938	19.7897	19.7853	(88)		
util rest of house	0.9988	0.9961	0.9835	0.9334	0.7822	0.5520	0.3265
0.3600	0.7435	0.9690	0.9973	0.9990	(89)		
MIT 2	18.5029	18.6896	19.0237	19.3850	19.6816	19.7846	19.8025
19.8019	19.7341	19.3507	18.8083	18.5256	(90)		
Living area fraction = 30.00 ÷ 100.00 =						0.3000	(91)
MIT	18.8274	19.0131	19.3480	19.7116	20.0198	20.1364	20.1600
20.1588	20.0746	19.6741	19.1307	18.8490	(92)		
Temperature adjustment						0.0000	
adjusted MIT	18.8274	19.0131	19.3480	19.7116	20.0198	20.1364	20.1600
20.1588	20.0746	19.6741	19.1307	18.8490	(93)		

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984		0.9951		0.9811	0.9317		0.7946		0.5830		0.3659	
0.4029	0.7673		0.9674		0.9966	0.9987		(94)					
Useful gains W	550.8413	696.6365	855.0623	1014.2601	972.3744	723.0512	438.6158	437.3406	691.6722	686.5933	555.7488	510.8960	(95)
Ext temp.	4.5000		5.0000		6.8000		8.7000		11.7000		14.6000		16.9000
16.9000	14.3000		10.8000		7.0000		4.9000		(96)				
Heat loss rate W	1979.2932	1927.4649	1725.9433	1502.5129	1129.7685	750.1051	440.7409	440.5785	785.0532	1210.8502	1661.6744	1918.6384	(97)
Space heating kWh	1062.7682	827.1167	647.9354	351.5421	117.1012	—	—	—	—	390.0472	796.2664	1047.3603	(98)
Space heating (October to May)											5240.1376		(98)
Space heating per m²											52.4014		(99)

8c. Space cooling requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext temp.	—	—	—	—	—	14.6000	16.9000		16.9000		—	—
—	—											
Heat loss rate W	—	—	—	—	—	1273.5781	959.8995	959.8995	—	—	—	(100)
Utilisation	—	—	—	—	—	0.9006	0.9563		0.9402		—	—
—	—	(101)										
Useful loss W	—	—	—	—	—	1147.0376	917.9945	902.4988	—	—	—	(102)
Gains W	—	—	—	—	—	1554.3031	1503.5968	1373.2060	—	—	—	(103)
Space cooling kWh	—	—	—	—	—	293.2312	435.6880	350.2062	—	—	—	(104)
Space heating kWh	—	—	—	—	—	8.2706	0.5857		0.8754		—	—
—	—	(98)										
month included	—	—	—	—	—	1	1	1	—	—	—	—
Space cooling kWh	—	—	—	—	—	293.2312	435.6880	350.2062	—	—	—	(104)
Cooled fraction = 100.00 ÷ 100.00 =										1.0000	(105)	
Intermittency factor	—	—	—	—	—	0.2500	0.2500		0.2500		—	—

SAP 2009 WORKSHEET FOR NEW DWELLING AS BUILT (Version 9.90, March 2010)**CALCULATION OF ENERGY RATINGS**

calculated by program bsap2009 version 5.34q, printed on 07 Jun 2012 at 12:39

Filename: EW-1a-detached.bsp (File saved: 29 Aug 2011 11:37)

1a-detached

BD8 7LL

1. Overall dwelling dimensions

	Area (m ²)	Av. storey height (m)	Volume (m ³)	
Ground floor	50.0000	2.4000	120.0000	(1b) - (3b)
First floor	50.0000	2.6000	130.0000	(1c) - (3c)
Total floor area	100.0000			(4)
Dwelling volume (m ³)			250.0000	(5)

2. Ventilation rate

	main	sec.	other	total	m ³ per hour				
Number of chimneys	0	+	0	+	0	=	0	×	40
Number of open flues	0	+	0	+	0	=	0	×	20
Number of intermittent fans				3	×	10	30		(7a)
Number of passive vents				0	×	10	0		(7b)
Number of flueless gas fires				0	×	40	0		(7c)

ach
0.1200 (8)

Infiltration due to chimneys, flues and fans

Pressure test

q50 measured in this dwelling

Infiltration rate

Number of sides sheltered

Shelter factor

Infiltration rate incorporating shelter factor

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.4000		5.1000		5.1000	4.5000		4.1000		3.9000		3.7000
3.7000	4.2000		4.5000		4.8000	5.1000		(22)				
Wind factor	1.3500		1.2750		1.2750	1.1250		1.0250		0.9750		0.9250
0.9250	1.0500		1.1250		1.2000	1.2750		(22a)				
Adj infilt rate	0.3672		0.3468		0.3468	0.3060		0.2788		0.2652		0.2516
0.2516	0.2856		0.3060		0.3264	0.3468		(22b)				
Natural ventilation												
Effective ach	0.5674		0.5601		0.5601	0.5468		0.5389		0.5352		0.5317
0.5317	0.5408		0.5468		0.5533	0.5601		(25)				

3. Heat losses and heat loss parameter

Element	Gross area (m ²)		Openings (m ²)	Net area (m ²)	U-value (W/m ² K)	A × U (W/K)	kappa (kJ/m ² K)	A × kappa (kJ/K)					
Doors			2.0000		3.0000		6.0000		(26)				
Windows (U _w = 1.20)			23.0000		1.1450		26.3359		(27)				
Ground floor			50.0000		0.2000		10.0000	80.0000	4000.0000	(28a)			
Walls	150.00	25.00	125.0000	0.1800		22.5000	60.0000	7500.0000	(29a)				
Roof	50.00			50.0000		0.1300	6.5000	9.0000	450.0000	(30)			
Total area of external elements			250.0000						(31)				
Fabric heat loss					71.3359				(33)				
Internal wall			200.0000			75.0000	15000.0000		(32c)				
Internal floor level 1 from below			50.0000				9.0000	450.0000	(32e)				
Internal floor level 1 from above			50.0000				18.0000	900.0000	(32d)				
Heat capacity							28300.0000		(34)				
Thermal mass parameter							283.0000		(35)				
Thermal bridges (0.080 × total area)					20.0000				(36)				
Total fabric heat loss					91.3359				(37)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Vent loss	46.8120		46.2111		46.2111	45.1125		44.4563		44.1512		43.8612	
43.8612	44.6147		45.1125		45.6446	46.2111		(38)					
Heat transfer coeff	138.1479	137.5470	137.5470	136.4484	135.7922	135.4870	135.1971	135.1971	135.9505	136.4484	136.9805	137.5470	(39)
Heat transfer coeff (average)											136.5242		(39)
HLP	1.3815		1.3755		1.3755	1.3645		1.3579		1.3549		1.3520	
1.3520	1.3595		1.3645		1.3698	1.3755		(40)					
HLP (average)											1.3652		(40)

Days in month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements

Assumed occupancy											2.7395	(42)	
Average daily water use (litres/day)											104.4881	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily water use	114.9370	110.7574	106.5779	102.3984	98.2189	94.0393		94.0393		98.2189		102.3984	
106.5779	110.7574	114.9370	(44)										
Energy content	170.8560	149.4317	154.2001	134.4354	128.9940	111.3120	103.1469	118.3626	119.7762	139.5877	152.3709	165.4649	(45)
Energy content (annual)											1647.9384	(45)	
Distribution loss	25.6284		22.4148		23.1300		20.1653		19.3491		16.6968		15.4720
17.7544	17.9664		20.9381		22.8556		24.8197		(46)				
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		(57)				

Combi loss	50.9589		46.0274		50.9589		49.3151		50.0513		46.3756		47.9214
50.0513	49.3151		50.9589		49.3151		50.9589		(61)				
Total	221.8149	195.4591	205.1591	183.7505	179.0452	157.6876	151.0684	168.4139	169.0913	190.5466	201.6859	216.4238	(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)											0.0000		(63)
Output from w/h	221.8149	195.4591	205.1591	183.7505	179.0452	157.6876	151.0684	168.4139	169.0913	190.5466	201.6859	216.4238	(64)
Output from water heater (annual)											2240.1461		(64)
Heat gains (kWh)	69.5493		61.1929		64.0113		57.0285		55.4033		48.6051		46.2767
51.8684	52.1544		59.1526		62.9921		67.7568		(65)				

5. Internal gains

(in watts)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic	164.3716	164.3716	164.3716	164.3716	164.3716	164.3716	164.3716	164.3716	164.3716	164.3716	164.3716	164.3716	(66)
Lighting	97.1202		86.2613		70.1524		53.1099		39.7003		33.5166		36.2159
47.0748	63.1837		80.2262		93.6358		99.8195		(67)				
Appliances	382.5788	386.5487	376.5445	355.2468	328.3622	303.0945	286.2141	282.2441	292.2483	313.5461	340.4307	365.6984	(68)
Cooking	54.1767		54.1767		54.1767		54.1767		54.1767		54.1767		54.1767
54.1767	54.1767		54.1767		54.1767		54.1767		(69)				
Pumps, fans	10.0000		10.0000		10.0000		10.0000		10.0000		10.0000		10.0000
10.0000	10.0000		10.0000		10.0000		10.0000		(70)				
Losses	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	(71)
Water heating	93.4803		91.0609		86.0367		79.2063		74.4668		67.5071		62.1999
69.7156	72.4366		79.5062		87.4890		91.0710		(72)				
Total internal	692.1464	682.8381	651.7008	606.5302	561.4965	523.0854	503.5971	518.0017	546.8358	592.2457	640.5227	675.5560	(73)

6. Solar gains

(calculation for January)

<u>Orientation</u>		<u>Area</u>	<u>Flux</u>	<u>g</u>	<u>FF</u>	<u>Shading</u>	<u>Gains (W)</u>						
East	0.9 ×	23.0000	19.8726		0.72	0.7000		0.77	159.6414		(76)		
						total:		159.6414		(83-1)			

Solar gains	159.6414	309.4304	494.5694	734.3182	893.4562	932.2760	904.8795	787.5364	591.2779	376.8281	198.4757	131.6884	(83)
Total gains	851.7878	992.2685	1146.2702	1340.8484	1454.9527	1455.3614	1408.4765	1305.5381	1138.1137	969.0737	838.9984	807.2444	(84)

7. Mean internal temperature

Living room temperature during heating periods Th 1

										<u>°C</u>			
										21.0000			(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.9036		57.1522		57.1522		57.6124		57.8907		58.0211		58.1456
58.1456	57.8233		57.6124		57.3885		57.1522						
alpha	4.7936		4.8101		4.8101		4.8408		4.8594		4.8681		4.8764
4.8764	4.8549		4.8408		4.8259		4.8101						

external temp.	4.5000	5.0000	6.8000	8.7000	11.7000	14.6000	16.9000
16.9000	14.3000	10.8000	7.0000	4.9000			
util living area	0.9944	0.9880	0.9667	0.9071	0.7658	0.5755	0.3910
0.4208	0.7259	0.9401	0.9895	0.9950	(86)		
MIT 1	19.8266	19.9994	20.3071	20.6206	20.8778	20.9757	20.9971
20.9959	20.9304	20.6051	20.1075	19.8429	(87)		
Th 2	19.7807	19.7853	19.7853	19.7938	19.7988	19.8012	19.8034
19.8034	19.7976	19.7938	19.7897	19.7853	(88)		
util rest of house	0.9923	0.9835	0.9541	0.8749	0.6971	0.4768	0.2783
0.3001	0.6247	0.9104	0.9849	0.9931	(89)		
MIT 2	18.7439	18.9181	19.2176	19.5140	19.7285	19.7923	19.8029
19.8027	19.7677	19.5104	19.0300	18.7639	(90)		
Living area fraction = 30.00 ÷ 100.00 =						0.3000	(91)
MIT	19.0687	19.2424	19.5444	19.8460	20.0733	20.1473	20.1612
20.1607	20.1165	19.8388	19.3533	19.0876	(92)		
Temperature adjustment						0.0000	
adjusted MIT	19.0687	19.2424	19.5444	19.8460	20.0733	20.1473	20.1612
20.1607	20.1165	19.8388	19.3533	19.0876	(93)		

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9906		0.9809		0.9510	0.8765		0.7141		0.5062		0.3123	
0.3365	0.6537		0.9117		0.9826	0.9916		(94)					
Useful gains W	843.7664	973.3284	1090.0953	1175.2602	1038.9171	736.7122	439.8488	439.3700	744.0143	883.5400	824.4322	800.4251	(95)
Ext temp.	4.5000		5.0000		6.8000		8.7000		11.7000		14.6000		16.9000
16.9000	14.3000		10.8000		7.0000		4.9000		(96)				
Heat loss rate W	2012.6341	1959.0054	1752.9580	1520.8485	1137.0299	751.5861	440.9010	440.8384	790.7545	1233.3357	1692.1593	1951.4603	(97)
Space heating kWh	869.6376	662.3749	493.1698	248.8236	72.9959		—	—	—	—	260.2480	624.7635	856.3702
(98)													
Space heating (October to May)											4088.3835		(98)
Space heating per m²											40.8838		(99)

8c. Space cooling requirement - not applicable9a. Energy requirements

Fraction of space heat from secondary						0.0000		(201)					
Fraction of space heat from main system						1.0000		(202)					
Efficiency of main heating system						88.5000		(206)					
Efficiency of secondary heating system						—		(208)					
	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	869.6376	662.3749	493.1698	248.8236	72.9959		—	—	—	—	260.2480	624.7635	856.3702

(98)

Space heating fuel (main heating system)

982.6413	748.4463	557.2540	281.1566	82.4812		–	–	–	–	294.0655	705.9475	967.6499
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(211)

Space heating fuel (secondary)

0.0000		0.0000		0.0000		0.0000		0.0000		–	–	–
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0.0000		0.0000		0.0000		(215)						
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Water heating requirement

221.8149	195.4591	205.1591	183.7505	179.0452	157.6876	151.0684	168.4139	169.0913	190.5466	201.6859	216.4238	(64)
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Efficiency of water heater

78.4000 (216)

86.2421		85.9763		85.2727		83.9083		81.0799		78.4000		78.4000
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78.4000

78.4000		83.9297		85.8025		86.2582		(217)				
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Water heating fuel

257.2003	227.3407	240.5918	218.9898	220.8257	201.1321	192.6892	214.8136	215.6777	227.0311	235.0584	250.9022	(219)
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Annual totals:kWh/year

Space heating fuel used, main system

4619.6424 (211)

Space heating fuel (secondary)

0.0000 (215)

Water heating fuel

2702.2527 (219)

Electricity for pumps and fans:

central heating pump

130.0000 (230c)

boiler flue fan

45.0000 (230e)

Total electricity for the above

175.0000 (231)

Electricity for lighting (30% fixed LEL)

686.0691 (232)

10a. Fuel costs using Table 12 priceskWh/yearp/kWh£/year

Space heating - main system

4619.6424 3.1000 143.2089 (240)

Space heating - secondary

0.0000 – 0.0000 (242)

Water heating

2702.2527 3.1000 83.7698 (247)

Pumps and fans for heating

175.0000 11.4600 20.0550 (249)

Electricity for lighting

686.0691 11.4600 78.6235 (250)

Additional standing charges

106.0000 (251)

Total energy cost

431.6573 (255)

11a. SAP rating

Energy cost deflator

0.4700 (256)

Energy cost factor (ECF)

1.3992 (257)

SAP value

80.4816

SAP rating**80** (258)**SAP band****C**

10a. <u>Fuel costs using PCDF prices (rev 322)</u>	<u>kWh/year</u>	<u>p/kWh</u>	<u>£/year</u>	
Space heating - main system	4619.6424	3.3700	155.6819	(240)
Space heating - secondary	0.0000	–	0.0000	(242)
Water heating	2702.2527	3.3700	91.0659	(247)
Pumps and fans for heating	175.0000	12.7300	22.2775	(249)
Electricity for lighting	686.0691	12.7300	87.3366	(250)
Additional standing charges			<u>113.0000</u>	(251)
Total energy cost			469.3620	(255)

12a. <u>Carbon dioxide emissions</u>	<u>Energy</u> <u>(kWh/year)</u>	<u>Emission</u> <u>factor</u>	<u>Emissions</u> <u>(kg/year)</u>	
Space heating - main system	4619.6424	0.1980	914.6892	(261)
Space heating - secondary	0.0000	–	0.0000	(263)
Water heating	2702.2527	0.1980	<u>535.0460</u>	(264)
Space and water heating			1449.7352	(265)
Pumps and fans	175.0000	0.5170	90.4750	(267)
Electricity for lighting	686.0691	0.5170	<u>354.6977</u>	(268)
Total kg/year			1894.9079	(272)

	<u>kg/m²/year</u>	
CO2 emissions per m²	18.9500	(273)
EI value	82.4884	
EI rating	82	(274)
EI band	B	

13a. <u>Primary energy</u>	<u>Energy</u> <u>(kWh/year)</u>	<u>Primary</u> <u>factor</u>	<u>P.Energy</u> <u>(kWh/year)</u>	
Space heating - main system	4619.6424	1.0200	4712.0352	(261)
Space heating - secondary	0.0000	–	0.0000	(263)
Water heating	2702.2527	1.0200	<u>2756.2977</u>	(264)
Space and water heating			7468.3329	(265)
Pumps and fans	175.0000	2.9200	511.0000	(267)
Electricity for lighting	686.0691	2.9200	<u>2003.3218</u>	(268)
Primary energy kWh/year			9982.6547	(272)
Primary energy kWh/m²/year			99.8265	(273)

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.10 \times (1 + 0.29 \times 0.00) / 0.8850 = 3.503$, stars = 4
Main heating environmental impact	$0.198 \times (1 + 0.29 \times 0.00) / 0.8850 = 0.2237$, stars = 4
Water heating energy efficiency	$3.10 / 0.8267 = 3.750$, stars = 4
Water heating environmental impact	$0.198 / 0.8267 = 0.2395$, stars = 4

SAP 2009 WORKSHEET FOR NEW DWELLING AS BUILT (Version 9.90, March 2010)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

Approved Document L1A, 2010 Edition

calculated by program bsap2009 version 5.34q, printed on 07 Jun 2012 at 12:39

Filename: EW-1a-detached.bsp (File saved: 29 Aug 2011 11:37)

1a-detached

BD8 7LL

1. Overall dwelling dimensions

	Area (m ²)	Av. storey height (m)	Volume (m ³)	
Ground floor	50.0000	2.4000	120.0000	(1b) - (3b)
First floor	50.0000	2.6000	130.0000	(1c) - (3c)
Total floor area	100.0000			(4)
Dwelling volume (m ³)			250.0000	(5)

2. Ventilation rate

	main	sec.	other	total	m ³ per hour			
Number of chimneys	0	+	0	+	0	=	0	× 40
Number of open flues	0	+	0	+	0	=	0	× 20
Number of intermittent fans				3	× 10		30	
Number of passive vents				0	× 10		0	
Number of flueless gas fires				0	× 40		0	

ach
0.1200 (8)

Infiltration due to chimneys, flues and fans

Pressure test

q50 measured in this dwelling 4.0000

Infiltration rate

Number of sides sheltered

Shelter factor

Infiltration rate incorporating shelter factor

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.4000		5.1000		5.1000	4.5000		4.1000		3.9000		3.7000
3.7000	4.2000		4.5000		4.8000	5.1000		(22)				
Wind factor	1.3500		1.2750		1.2750	1.1250		1.0250		0.9750		0.9250
0.9250	1.0500		1.1250		1.2000	1.2750		(22a)				
Adj infilt rate	0.3672		0.3468		0.3468	0.3060		0.2788		0.2652		0.2516
0.2516	0.2856		0.3060		0.3264	0.3468		(22b)				
Natural ventilation												
Effective ach	0.5674		0.5601		0.5601	0.5468		0.5389		0.5352		0.5317
0.5317	0.5408		0.5468		0.5533	0.5601		(25)				

Element	Gross area (m ²)		Openings (m ²)	Net area (m ²)	U-value (W/m ² K)	A × U (W/K)	kappa (kJ/m ² K)	A × kappa (kJ/K)					
Doors			2.0000		3.0000		6.0000						(26)
Windows (U _w = 1.20)			23.0000		1.1450		26.3359						(27)
Ground floor			50.0000		0.2000		10.0000		80.0000	4000.0000			(28a)
Walls	150.00	25.00	125.0000	0.1800		22.5000		60.0000	7500.0000				(29a)
Roof	50.00			50.0000		0.1300		6.5000		9.0000	450.0000		(30)
Total area of external elements			250.0000					(31)					
Fabric heat loss					71.3359			(33)					
Internal wall			200.0000			75.0000		15000.0000		(32c)			
Internal floor level 1 from below			50.0000				9.0000	450.0000			(32e)		
Internal floor level 1 from above			50.0000				18.0000	900.0000			(32d)		
Heat capacity							28300.0000	(34)					
Thermal mass parameter							283.0000	(35)					
Thermal bridges (0.080 × total area)					20.0000						(36)		
Total fabric heat loss					91.3359			(37)					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Vent loss	46.8120		46.2111		46.2111	45.1125		44.4563		44.1512		43.8612	
43.8612	44.6147		45.1125		45.6446	46.2111		(38)					
Heat transfer coeff	138.1479	137.5470	137.5470	136.4484	135.7922	135.4870	135.1971	135.1971	135.9505	136.4484	136.9805	137.5470	(39)
Heat transfer coeff (average)											136.5242		(39)
HLP	1.3815		1.3755		1.3755	1.3645		1.3579		1.3549		1.3520	
1.3520	1.3595		1.3645		1.3698	1.3755		(40)					
HLP (average)											1.3652		(40)

<u>Days in Month</u>												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	(41)

[illegible]

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)							
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	50.0513	46.3756	47.9214					
50.0513	49.3151	50.9589	49.3151	50.9589	50.9589	(61)							
Total	221.8149	195.4591	205.1591	183.7505	179.0452	157.6876	151.0684	168.4139	169.0913	190.5466	201.6859	216.4238	(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	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)				
Solar input (sum of months)											0.0000	(63)	
Output from w/h	221.8149	195.4591	205.1591	183.7505	179.0452	157.6876	151.0684	168.4139	169.0913	190.5466	201.6859	216.4238	(64)
Output from water heater (annual)											2240.1461	(64)	
Heat gains (kWh)	69.5493	61.1929	64.0113	57.0285	55.4033	48.6051	46.2767						
51.8684	52.1544	59.1526	62.9921	67.7568	(65)								

5. Internal gains

(in watts)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	(66)
Lighting	38.8481		34.5045		28.0610		21.2439		15.8801		13.4067		14.4864
18.8299	25.2735		32.0905		37.4543		39.9278		(67)				
Appliances	256.3278	258.9876	252.2848	238.0153	220.0027	203.0733	191.7634	189.1036	195.8064	210.0759	228.0885	245.0179	(68)
Cooking	36.6976		36.6976		36.6976		36.6976		36.6976		36.6976		36.6976
36.6976	36.6976		36.6976		36.6976		36.6976		(69)				
Pumps, fans	10.0000		10.0000		10.0000		10.0000		10.0000		10.0000		10.0000
10.0000	10.0000		10.0000		10.0000		10.0000		(70)				
Losses	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	(71)
Water heating	93.4803		91.0609		86.0367		79.2063		74.4668		67.5071		62.1999
69.7156	72.4366		79.5062		87.4890		91.0710		(72)				
Total internal	462.7490	458.6459	440.4753	412.5585	384.4425	358.0800	342.5426	351.7419	367.6094	395.7654	427.1247	450.1095	(73)

6. Solar gains

(calculation for January)

<u>Orientation</u>	<u>Area</u>	<u>Flux</u>	<u>g</u>	<u>FF</u>	<u>Shading</u>	<u>Gains (W)</u>							
East	0.9 ×	23.0000	19.8726	0.72	0.7000	0.77	159.6414	(76)					
					total:	159.6414	(83-1)						
Solar gains	159.6414	309.4304	494.5694	734.3182	893.4562	932.2760	904.8795	787.5364	591.2779	376.8281	198.4757	131.6884	(83)
Total gains	622.3904	768.0763	935.0447	1146.8767	1277.8987	1290.3560	1247.4221	1139.2784	958.8873	772.5935	625.6005	581.7980	(84)

7. Mean internal temperature

Living room temperature during heating periods Th 1											<u>°C</u>		
											21.0000	(85)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.9036		57.1522		57.1522		57.6124		57.8907		58.0211		58.1456
58.1456	57.8233		57.6124		57.3885		57.1522						
alpha	4.7936		4.8101		4.8101		4.8408		4.8594		4.8681		4.8764

4.8764	4.8549	4.8408	4.8259	4.8101			
external temp.	4.5000	5.0000	6.8000	8.7000	11.7000	14.6000	16.9000
16.9000	14.3000	10.8000	7.0000	4.9000			
util living area	0.9986	0.9959	0.9847	0.9438	0.8244	0.6367	0.4396
0.4790	0.8072	0.9734	0.9970	0.9988	(86)		
MIT 1	19.6419	19.8227	20.1535	20.5105	20.8278	20.9626	20.9951
20.9929	20.8875	20.4745	19.9380	19.6607	(87)		
Th 2	19.7807	19.7853	19.7853	19.7938	19.7988	19.8012	19.8034
19.8034	19.7976	19.7938	19.7897	19.7853	(88)		
util rest of house	0.9980	0.9942	0.9783	0.9212	0.7617	0.5327	0.3139
0.3433	0.7126	0.9577	0.9955	0.9983	(89)		
MIT 2	18.5603	18.7440	19.0709	19.4182	19.6949	19.7869	19.8026
19.8022	19.7449	19.3936	18.8630	18.5828	(90)		
Living area fraction = 30.00 ÷ 100.00 =						0.3000	(91)
MIT	18.8848	19.0676	19.3957	19.7459	20.0348	20.1396	20.1604
20.1594	20.0877	19.7179	19.1855	18.9062	(92)		
Temperature adjustment						0.0000	
adjusted MIT	18.8848	19.0676	19.3957	19.7459	20.0348	20.1396	20.1604
20.1594	20.0877	19.7179	19.1855	18.9062	(93)		

8. Space heating requirement

Space heating requirements													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974		0.9929		0.9756	0.9201		0.7754		0.5635		0.3519	
0.3845	0.7384		0.9564		0.9945	0.9978		(94)					
Useful gains W	620.7515	762.6107	912.2544	1055.2412	990.8867	727.1169	439.0007	438.0244	708.0258	738.9375	622.1576	580.5163	(95)
Ext temp.	4.5000		5.0000		6.8000		8.7000		11.7000		14.6000		16.9000
16.9000	14.3000		10.8000		7.0000		4.9000		(96)				
Heat loss rate W	1987.2287	1934.9587	1732.4993	1507.1959	1131.8023	750.5454	440.7905	440.6652	786.8423	1216.8269	1669.1816	1926.5104	(97)
Space heating kWh	1016.6591	787.8178	610.2622	325.4074	104.8412	—	—	—	—	355.5497	753.8573	1001.4196	(98)
Space heating (October to May)										4955.8144			(98)
Space heating per m ²										49.5581			(99)

8c. Space cooling requirement - not applicable9a. Energy requirements

Fraction of space heat from secondary						0.0000		(201)						
Fraction of space heat from main system						1.0000		(202)						
Efficiency of main heating system						88.5000		(206)						
Efficiency of secondary heating system						—		(208)						
	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1016.6591	787.8178	610.2622	325.4074	104.8412	—	—	—	—	355.5497	753.8573	1001.4196	(98)	

Space heating fuel (main heating system)	1148.7673	890.1896	689.5618	367.6920	118.4647	–	–	–	–	401.7511	851.8161	1131.5476	(211)
Space heating fuel (secondary)	0.0000		0.0000		0.0000		0.0000		0.0000		–	–	–
–	0.0000		0.0000		0.0000	(215)							
Water heating requirement	221.8149	195.4591	205.1591	183.7505	179.0452	157.6876	151.0684	168.4139	169.0913	190.5466	201.6859	216.4238	(64)
Efficiency of water heater											78.4000		(216)
	86.5041		86.2902		85.7215		84.5682		81.8497		78.4000		78.4000
78.4000	78.4000		84.6930		86.1573		86.5192		(217)				
Water heating fuel	256.4213	226.5136	239.3320	217.2808	218.7488	201.1321	192.6892	214.8136	215.6777	224.9851	234.0904	250.1453	(219)
<u>Annual totals:</u>								<u>kWh/year</u>					
Space heating fuel used, main system								5599.7903	(211)				
Space heating fuel (secondary)								0.0000		(215)			
Water heating fuel								2691.8298	(219)				
Electricity for pumps and fans:													
central heating pump						130.0000			(230c)				
boiler flue fan						45.0000			(230e)				
Total electricity for the above								175.0000	(231)				
Electricity for lighting (30% fixed LEL)								686.0691	(232)				

10a and 11a do not apply

12a. Carbon dioxide emissions

	Energy (kWh/year)	Emission factor	Emissions (kg/year)	
Space heating - main system	5599.7903	0.1980	1108.7585	(261)
Space heating - secondary	0.0000	–	0.0000	(263)
Water heating	2691.8298	0.1980	532.9823	(264)
Space and water heating			1641.7408	(265)
Pumps and fans	175.0000	0.5170	90.4750	(267)
Electricity for lighting	686.0691	0.5170	354.6977	(268)
Total kg/year			2086.9135	(272)

Dwelling Carbon Dioxide Emission Rate (DER) kg/m²/year
20.8700 (273)

SAP 2009 WORKSHEET FOR NOTIONAL DWELLING (Version 9.90, March 2010)**CALCULATION OF TARGET EMISSIONS****Approved Document L1A, 2010 Edition**

calculated by program bsap2009 version 5.34q, printed on 07 Jun 2012 at 12:39

Filename: EW-1a-detached.bsp

1a-detached - notional**1. Overall dwelling dimensions**

	Area (m ²)	Av. storey height (m)	Volume (m ³)	
Ground floor	50.0000	2.4000	120.0000	(1b) - (3b)
First floor	50.0000	2.6000	130.0000	(1c) - (3c)
Total floor area	100.0000			(4)
Dwelling volume (m ³)			250.0000	(5)

2. Ventilation rate

	main	sec.	other	total	m ³ per hour							
Number of chimneys	0	+	0	+	0	=	0	×	40	0		(6a)
Number of open flues	0	+	0	+	0	=	0	×	20	0		(6b)
Number of intermittent fans				3	×	10	30				(7a)	
Number of passive vents				0	×	10	0				(7b)	
Number of flueless gas fires				0	×	40	0				(7c)	
Infiltration due to chimneys, flues and fans								ach	0.1200		(8)	
Pressure test				Yes								
Design q50				10.0000								
Infiltration rate									0.6200		(18)	
Number of sides sheltered				2						(19)		
Shelter factor				0.8500						(20)		
Infiltration rate incorporating shelter factor									0.5270		(21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.4000		5.1000		5.1000	4.5000		4.1000		3.9000		3.7000
3.7000	4.2000		4.5000		4.8000	5.1000		(22)				
Wind factor	1.3500		1.2750		1.2750	1.1250		1.0250		0.9750		0.9250
0.9250	1.0500		1.1250		1.2000	1.2750		(22a)				
Adj infilt rate	0.7115		0.6719		0.6719	0.5929		0.5402		0.5138		0.4875
0.4875	0.5534		0.5929		0.6324	0.6719		(22b)				
Natural ventilation												
Effective ach	0.7531		0.7257		0.7257	0.6758		0.6459		0.6320		0.6188
0.6188	0.6531		0.6758		0.7000	0.7257		(25)				

3. Heat losses and heat loss parameter

Element	Gross area (m ²)		Openings (m ²)	Net area (m ²)	U-value (W/m ² K)	A × U (W/K)	TMP (kJ/K)					
Doors			1.8500		2.0000		3.7000				(26)	
Windows (U _w = 2.00)			23.1500		1.8519		42.8704				(27)	
Ground floor			50.0000		0.2500		12.5000				(28a)	
Walls	150.00	25.00	125.0000	0.3500		43.7500			(29a)			
Roof	50.00			50.0000		0.1600	8.0000				(30)	
Total area of external elements			250.0000					(31)				
Fabric heat loss					110.8204			(33)				
Thermal mass parameter (user-specified TMP)						250.0000		(35)				
Thermal bridges (0.11 × total area)					27.5000			(36)				
Total fabric heat loss					138.3204			(37)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Vent loss	62.1291		59.8737		59.8737	55.7494		53.2863		52.1407		51.0523
51.0523	53.8806		55.7494		57.7471	59.8737		(38)				
Heat transfer coeff	200.4495	198.1941	198.1941	194.0698	191.6067	190.4610	189.3727	189.3727	192.2010	194.0698	196.0675	198.1941
Heat transfer coeff (average)											194.3544	(39)
HLP	2.0045		1.9819		1.9819	1.9407		1.9161		1.9046		1.8937
1.8937	1.9220		1.9407		1.9607	1.9819		(40)				
HLP (average)											1.9435	(40)

Days in month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements

Assumed occupancy											2.7395	(42)
Average daily water use (litres/day)											104.4881	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily water use	114.9370	110.7574	106.5779	102.3984	98.2189	94.0393		94.0393		98.2189		102.3984
106.5779	110.7574	114.9370	(44)									
Energy content	170.8560	149.4317	154.2001	134.4354	128.9940	111.3120	103.1469	118.3626	119.7762	139.5877	152.3709	165.4649
Energy content (annual)											1647.9384	(45)
Distribution loss	25.6284		22.4148		23.1300		20.1653		19.3491		16.6968	15.4720
17.7544	17.9664		20.9381		22.8556		24.8197		(46)			
Cylinder volume						150.0000						(50)
Cylinder loss factor (kWh/litre/day)							0.0191					(51)
Volume factor							0.9283					(52)
Temperature factor							0.5400					(53)
Energy lost from cylinder in kWh/day (150 litres)											1.4364	(55)
Storage loss	44.5282		40.2190		44.5282		43.0918		44.5282		43.0918	44.5282

44.5282	43.0918	44.5282	43.0918	44.5282	(57)								
Primary circuit loss (annual)											610.0000	(58)	
Primary loss	51.8082	46.7945	51.8082	50.1370	51.8082	50.1370	51.8082						
51.8082	50.1370	51.8082	50.1370	51.8082	(59)								
Total	267.1924	236.4452	250.5366	227.6642	225.3304	204.5408	199.4833	214.6990	213.0050	235.9241	245.5996	261.8013	(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	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)							
Solar input (sum of months)											0.0000	(63)	
Output from w/h	267.1924	236.4452	250.5366	227.6642	225.3304	204.5408	199.4833	214.6990	213.0050	235.9241	245.5996	261.8013	(64)
Output from water heater (annual)											2782.2220	(64)	
Heat gains (kWh)	133.8787	119.2969	128.3407	119.2828	119.9596	111.5943	111.3655	116.4247	114.4086	123.4820	125.2463	132.0862	(65)

5. Internal gains

(in watts)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	136.9763	(66)
Lighting	38.8481		34.5045		28.0610	21.2439		15.8801		13.4067		14.4864	
18.8299	25.2735		32.0905		37.4543	39.9278		(67)					
Appliances	256.3278	258.9876	252.2848	238.0153	220.0027	203.0733	191.7634	189.1036	195.8064	210.0759	228.0885	245.0179	(68)
Cooking	36.6976		36.6976		36.6976	36.6976	36.6976		36.6976		36.6976		36.6976
36.6976	36.6976		36.6976		36.6976	36.6976	36.6976	(69)					
Pumps, fans	10.0000		10.0000		10.0000	10.0000	10.0000		10.0000		10.0000		10.0000
10.0000	10.0000		10.0000		10.0000	10.0000	10.0000	(70)					
Losses	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	(71)
Water heating	179.9445	177.5251	172.5009	165.6706	161.2361	154.9920	149.6848	156.4848	158.9009	165.9705	173.9532	177.5352	(72)
Total internal	549.2133	545.1102	526.9396	499.0227	471.2117	445.5649	430.0275	438.5112	454.0736	482.2297	513.5890	536.5738	(73)

6. Solar gains

(calculation for January)

<u>Orientation</u>		<u>Area</u>	<u>Flux</u>	<u>g</u>	<u>FF</u>	<u>Shading</u>	<u>Gains (W)</u>						
East/West	0.9 ×	23.1500	19.8726		0.72	0.7000	0.77	160.6825	(76)				
						total:	160.6825	(83-1)					

Solar gains	160.6825	311.4484	497.7948	739.1072	899.2831	938.3561	910.7809	792.6725	595.1341	379.2856	199.7701	132.5472	(83)
Total gains	709.8958	856.5586	1024.7344	1238.1300	1370.4948	1383.9209	1340.8084	1231.1837	1049.2077	861.5153	713.3591	669.1210	(84)

7. Mean internal temperature

Living room temperature during heating periods Th 1											<u>°C</u>		
											21.0000	(85)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.6444		35.0386		35.0386	35.7832		36.2432		36.4612		36.6708	
36.6708	36.1312		35.7832		35.4186	35.0386							
alpha	3.3096		3.3359		3.3359	3.3855		3.4162		3.4307		3.4447	
3.4447	3.4087		3.3855		3.3612	3.3359							

8. Space heating requirement

8c. Space cooling requirement - not applicable

[illegible]

	1684.3879	1350.1105	1139.0339	716.1901	332.3631	—	—	—	—	678.6560	1253.9083	1635.6680	(211)
Space heating fuel (secondary)	147.6647	118.3597	99.8553		62.7860		29.1372		—	—	—	—	59.4955
109.9260	143.3936	(215)											
Water heating requirement	267.1924	236.4452	250.5366	227.6642	225.3304	204.5408	199.4833	214.6990	213.0050	235.9241	245.5996	261.8013	(64)
Efficiency of water heater											68.8000		(216)
	77.0076		76.8507		76.4532		75.7082		73.8871		68.8000		68.8000
68.8000	68.8000		75.5097		76.6618		76.9938		(217)				
Water heating fuel													
	346.9688	307.6683	327.6991	300.7129	304.9658	297.2977	289.9467	312.0625	309.6003	312.4421	320.3676	340.0291	(219)
<u>Annual totals:</u>								<u>kWh/year</u>					
Space heating fuel used, main system								8790.3178					(211)
Space heating fuel (secondary)								770.6179					(215)
Water heating fuel								3769.7609					(219)
Electricity for pumps and fans:													
central heating pump							130.0000						(230c)
boiler flue fan							45.0000						(230e)
Total electricity for the above								175.0000					(231)
Electricity for lighting (30% fixed LEL)								686.0691					(232)

10a and 11a do not apply

12a. Carbon dioxide emissions

	Energy (kWh/year)	Emission factor	Emissions (kg/year)	
Space heating - main system	8790.3178	0.1940	1705.3217	(261)
Space heating - secondary	770.6179	0.4220	325.2007	(263)
Water heating	3769.7609	0.1940	731.3336	(264)
Space and water heating			2761.8560	(265)
Pumps and fans	175.0000	0.4220	73.8500	(267)
Electricity for lighting	686.0691	0.4220	289.5212	(268)
Total kg/year			3125.2272	(272)

	<u>kg/m²/year</u>	
Emissions per m² for space and water heating	28.3571	(272a)
Emissions per m² for lighting	2.8952	(272b)
Target Carbon Dioxide Emission Rate (TER)	19.4900	(273)
= [(28.3571 × 1.00 × 1.0206) + (2.8952 × 1.2251)] × 0.60		

SAP 2009 WORKSHEET (Version 9.90, March 2010)**CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING**

calculated by program bsap2009 version 5.34q, printed on 07 Jun 2012 at 12:39

Filename: EW-1a-detached.bsp (File saved: 29 Aug 2011 11:37)

1a-detached - with improvements

BD8 7LL

With improvements:

E Low energy lighting

N Solar water heating

U Solar photovoltaic (PV) panels

V Wind turbine

1. Overall dwelling dimensions

	Area (m ²)	Av. storey height (m)	Volume (m ³)	
Ground floor	50.0000	2.4000	120.0000	(1b) - (3b)
First floor	50.0000	2.6000	130.0000	(1c) - (3c)
Total floor area	100.0000			(4)
Dwelling volume (m ³)			250.0000	(5)

2. Ventilation rate

	main	sec.	other	total	m ³ per hour			
Number of chimneys	0	+	0	+	0	=	0	× 40
Number of open flues	0	+	0	+	0	=	0	× 20
Number of intermittent fans				3	× 10		30	(7a)
Number of passive vents				0	× 10		0	(7b)
Number of flueless gas fires				0	× 40		0	(7c)

							<u>ach</u>		
Infiltration due to chimneys, flues and fans							0.1200	(8)	
Pressure test				Yes					
q50 measured in this dwelling				4.0000					
Infiltration rate							0.3200	(18)	
Number of sides sheltered				2				(19)	
Shelter factor				0.8500				(20)	
Infiltration rate incorporating shelter factor							0.2720	(21)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.4000		5.1000		5.1000	4.5000		4.1000		3.9000		3.7000
3.7000	4.2000		4.5000		4.8000	5.1000		(22)				
Wind factor	1.3500		1.2750		1.2750	1.1250		1.0250		0.9750		0.9250
0.9250	1.0500		1.1250		1.2000	1.2750		(22a)				
Adj infilt rate	0.3672		0.3468		0.3468	0.3060		0.2788		0.2652		0.2516

[illegible]

10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	(70)								
Losses	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	-109.5810	(71)
Water heating	<u>93.4803</u>		<u>91.0609</u>		<u>86.0367</u>		<u>79.2063</u>		<u>74.4668</u>		<u>67.5071</u>		<u>62.1999</u>	
69.7156	<u>72.4366</u>		<u>79.5062</u>		<u>87.4890</u>		<u>91.0710</u>		(72)					
Total internal	652.1558	647.3187	622.8145	584.6614	545.1493	509.2845	488.6846	498.6179	520.8190	559.2114	601.9667	634.4539	(73)	

6. Solar gains

(calculation for January)

<u>Orientation</u>		<u>Area</u>	<u>Flux</u>	<u>g</u>	<u>FF</u>	<u>Shading</u>	<u>Gains (W)</u>							
East	0.9 ×	23.0000	19.8726		0.72	0.7000		0.77	<u>159.6414</u>		(76)			
						total:		159.6414		(83-1)				

Solar gains	159.6414	309.4304	494.5694	734.3182	893.4562	932.2760	904.8795	787.5364	591.2779	376.8281	198.4757	131.6884	(83)	
Total gains	811.7972	956.7491	1117.3839	1318.9796	1438.6055	1441.5605	1393.5641	1286.1544	1112.0969	936.0394	800.4425	766.1423	(84)	

7. Mean internal temperature

Living room temperature during heating periods Th 1

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	56.9036		57.1522		57.1522	57.6124		57.8907		58.0211		58.1456		
58.1456	57.8233		57.6124		57.3885	57.1522								
alpha	4.7936		4.8101		4.8101	4.8408		4.8594		4.8681		4.8764		
4.8764	4.8549		4.8408		4.8259	4.8101								
external temp.	4.5000		5.0000		6.8000	8.7000		11.7000		14.6000		16.9000		
16.9000	14.3000		10.8000		7.0000	4.9000								
util living area	0.9954		0.9896		0.9697	0.9117		0.7712		0.5803		0.3951		
0.4269	0.7375		0.9468		0.9914	0.9960		(86)						
MIT 1	19.7947		19.9719		20.2869	20.6092		20.8739		20.9748		20.9969		
20.9957	20.9254		20.5847		20.0774	19.8099		(87)						
Th 2	19.7807		19.7853		19.7853	19.7938		19.7988		19.8012		19.8034		
19.8034	19.7976		19.7938		19.7897	19.7853		(88)						
util rest of house	0.9937		0.9857		0.9580	0.8805		0.7029		0.4811		0.2813		
0.3045	0.6366		0.9195		0.9875	0.9944		(89)						
MIT 2	18.7123		18.8912		19.1986	19.5043		19.7260		19.7919		19.8029		
19.8027	19.7652		19.4927		19.0006	18.7313		(90)						
Living area fraction = 30.00 ÷ 100.00 =										0.3000		(91)		
MIT	19.0370		19.2154		19.5251	19.8358		20.0703		20.1468		20.1611		
20.1606	20.1132		19.8203		19.3236	19.0549		(92)						
Temperature adjustment										0.0000				
adjusted MIT	19.0370		19.2154		19.5251	19.8358		20.0703		20.1468		20.1611		
20.1606	20.1132		19.8203		19.3236	19.0549		(93)						

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9922		0.9833		0.9549	0.8817		0.7196		0.5106		0.3156	
0.3415	0.6654		0.9202		0.9855	0.9931		(94)					
Useful gains W	805.4707	940.8010	1067.0169	1162.9885	1035.1892	736.0853	439.7906	439.2563	739.9410	861.3819	788.8035	760.8854	(95)
Ext temp.	4.5000		5.0000		6.8000		8.7000		11.7000		14.6000		16.9000
16.9000	14.3000		10.8000		7.0000		4.9000		(96)				
Heat loss rate W	2008.2597	1955.2817	1750.2989	1519.4588	1136.6268	751.5180	440.8933	440.8236	790.3132	1230.8110	1688.0986	1946.9626	(97)
Space heating kWh	894.8749	681.7310	508.3618	256.6586	75.4696		—	—	—	—	274.8552	647.4925	882.4414
(98)													
Space heating (October to May)											4221.8851		(98)
Space heating per m²											42.2189		(99)

8c. Space cooling requirement - not applicable

9a. Energy requirements

Fraction of space heat from secondary						0.0000		(201)					
Fraction of space heat from main system						1.0000		(202)					
Efficiency of main heating system						88.5000		(206)					
Efficiency of secondary heating system						–		(208)					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	894.8749	681.7310	508.3618	256.6586	75.4696	–	–	–	–	274.8552	647.4925	882.4414	
(98)													
Space heating fuel (main heating system)	1011.1581	770.3175	574.4201	290.0097	85.2764	–	–	–	–	310.5709	731.6300	997.1089	
(211)													
Space heating fuel (secondary)	0.0000		0.0000		0.0000	0.0000		0.0000		–	–	–	
–	0.0000		0.0000		0.0000	(215)							
Water heating requirement	195.4474	152.5908	135.8504	88.9736		60.0152	35.2066		29.0248		63.6975		
90.3536	134.7983	170.3366	194.5765	(64)									
Efficiency of water heater										78.4000		(216)	
	86.5024		86.4628		86.1593	85.6593		83.7223		78.4000		78.4000	
78.4000	78.4000		84.9010		86.1874	86.4871	(217)						
Water heating fuel	225.9445	176.4814	157.6735	103.8692	71.6836	44.9064		37.0215		81.2469		115.2469	
158.7712	197.6351	224.9775	(219)										
<u>Annual totals:</u>													
Space heating fuel used, main system							4770.4916	(211)					
Space heating fuel (secondary)							0.0000		(215)				
Water heating fuel							1595.4576	(219)					

Electricity for pumps and fans:		
central heating pump	130.0000	(230c)
boiler flue fan	45.0000	(230e)
pump for solar water heating	75.0000	(230g)
Total electricity for the above	250.0000	(231)
Electricity for lighting (100% fixed LEL)	403.5701	(232)
<u>Energy saving/generation technologies</u>		
PV generation $0.80 \times 2.50 \times 1073 \times 0.80 =$	-1716.8000	(233)
Wind generation	-611.5439	(234)

10a. <u>Fuel costs using Table 12 prices</u>	<u>kWh/year</u>	<u>p/kWh</u>	<u>£/year</u>	
Space heating - main system	4770.4916	3.1000	147.8852	(240)
Space heating - secondary	0.0000	–	0.0000	(242)
Water heating	1595.4576	3.1000	49.4592	(247)
Pumps and fans for heating	175.0000	11.4600	20.0550	(249)
Pump for solar water heating	75.0000	11.4600	8.5950	(249)
Electricity for lighting	403.5701	11.4600	46.2491	(250)
Additional standing charges			106.0000	(251)
Electricity generated - PVs	-1716.8000	11.4600	-196.7453	(252)
Electricity generated - wind	-611.5439	11.4600	-70.0829	(252)
Total energy cost			111.4153	(255)
11a. <u>SAP rating</u>				
Energy cost deflator			0.4700	(256)
Energy cost factor (ECF)			0.3611	(257)
SAP value			94.9621	
SAP rating (with improvements)			95	(258)
SAP band (with improvements)			A	

10a. <u>Fuel costs using PCDF prices (rev 322)</u>	<u>kWh/year</u>	<u>p/kWh</u>	<u>£/year</u>	
Space heating - main system	4770.4916	3.3700	160.7656	(240)
Space heating - secondary	0.0000	–	0.0000	(242)
Water heating	1595.4576	3.3700	53.7669	(247)
Pumps and fans for heating	175.0000	12.7300	22.2775	(249)
Pump for solar water heating	75.0000	12.7300	9.5475	(249)
Electricity for lighting	403.5701	12.7300	51.3745	(250)
Additional standing charges			113.0000	(251)
Electricity generated - PVs	-1716.8000	12.7300	-218.5486	(252)
Electricity generated - wind	-611.5439	12.7300	-77.8495	(252)
Total energy cost			114.3338	(255)

12a. <u>Carbon dioxide emissions</u>	Energy (kWh/year)	Emission factor	Emissions (kg/year)	
Space heating - main system	4770.4916	0.1980	944.5573	(261)
Space heating - secondary	0.0000	–	0.0000	(263)
Water heating	1595.4576	0.1980	<u>315.9006</u>	(264)
Space and water heating			1260.4579	(265)
Pumps and fans	250.0000	0.5170	129.2500	(267)
Electricity for lighting	403.5701	0.5170	208.6457	(268)
Electricity generated - PVs	-1716.8000	0.5290	-908.1872	(269)
Electricity generated - wind	-611.5439	0.5290	<u>-323.5067</u>	(269)
Total kg/year			366.6597	(272)
			<u>kg/m²/year</u>	
CO2 emissions per m²			3.6700	(273)
EI value			96.6116	
EI rating (with improvements)			97	(274)
EI band (with improvements)			A	
13a. <u>Primary energy</u>	Energy (kWh/year)	Primary factor	P.Energy (kWh/year)	
Space heating - main system	4770.4916	1.0200	4865.9014	(261)
Space heating - secondary	0.0000	–	0.0000	(263)
Water heating	1595.4576	1.0200	<u>1627.3667</u>	(264)
Space and water heating			6493.2682	(265)
Pumps and fans	250.0000	2.9200	730.0000	(267)
Electricity for lighting	403.5701	2.9200	1178.4246	(268)
Electricity generated - PVs	-1716.8000	2.9200	-5013.0560	(269)
Electricity generated - wind	-611.5439	2.9200	<u>-1785.7082</u>	(269)
Primary energy (with improvements) kWh/year			1602.9285	(272)
Primary energy (with improvements) kWh/m²/year			16.0293	(273)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2010 Edition

BD8 7LL

DWELLING AS BUILTDetached house, total floor area 100 m²**This reports covers items included within the SAP calculations.****It is not a complete report of regulations compliance.****1 TER and DER**

Fuel for main heating: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 19.49 kg/m²Dwelling Carbon Dioxide Emission Rate (DER) 20.87 kg/m²Excess emissions = 1.38 kg/m² (7.1%)

Fail

2 Fabric U-values

<u>Element</u>	<u>Average</u>	<u>Highest</u>	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	3.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.080

Reference: Thermal bridging for 1a.doc

3 Air permeability

Air permeability at 50 pascals:	4.00 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Boiler system with radiators or underfloor - Mains gas Data from manufacturer (make and model) Combi boiler Efficiency: 90.0% SEDBUK2005 Minimum: 90.0%	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water storage	No cylinder
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6 Controls

Space heating controls:	Programmer, room thermostat and TRVs	OK
Hot water controls:	No cylinder	

Boiler interlock	Yes	OK
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7 Low energy lights

Percentage of fixed lights with low-energy fittings:	30%	Fail
Minimum	75%	

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (East Pennines):	Slight	OK
Based on:		
Overshading:	Average	
Windows facing East:	23.00 m ² , No overhang	
Ventilation rate:	2.50	
Blinds/curtains:	Net curtain covering whole window	

10 Key features

External wall U-value	0.18 W/m ² K
Window U-value	1.20 W/m ² K
Air permeability	4.0 m ³ /m ² h

SAP 2009 OVERHEATING ASSESSMENT FOR NEW DWELLING AS BUILT (Version 9.90, March 2010)

calculated by program bsap2009 version 5.34q, printed on 07 Jun 2012 at 12:39

Filename: EW-1a-detached.bsp (File saved: 29 Aug 2011 11:37)

1a-detached

BD8 7LL

Dwelling type	Detached house
Number of storeys	2
Cross ventilation possible	No (windows on one side only)
Region	East Pennines
Front of dwelling faces	East
Overshading	Average
Overhangs	None
Thermal mass parameter	283.0 (calculated from construction elements)
Blinds, curtains, shutters	Net curtain covering whole window
Ventilation rate during hot weather (ach)	2.50 (windows open half the time)

Summer ventilation heat loss coefficient	206.25	(P1)
Transmission heat loss coefficient	<u>91.34</u>	(37)
Summer heat loss coefficient	297.59	(P2)

Overhangs

<u>Orientation</u>	<u>Ratio</u>	<u>Z overhangs</u>	<u>Overhang type</u>
East	-	1.000	None

Solar shading

<u>Orientation</u>	<u>Z blinds</u>	<u>Solar access</u>	<u>Overhangs</u>	<u>Z summer</u>
East 0.800	0.90	1.000		0.720 (P8)

Solar gains

(calculation for July)

<u>Orientation</u>	<u>Area</u>	<u>Flux</u>	<u>g</u>	<u>FF</u>	<u>Shading</u>	<u>Gains (W)</u>
East	0.9 ×	23.0000	112.6417	0.72	0.7000	0.720
<u>846.1211</u>						

total: 846.1211

	Jun	Jul	Aug	
Solar gains	872	846	736	(P3)
Internal gains	<u>513</u>	<u>494</u>	<u>508</u>	
Total summer gains	1385	1340	1244	(P5)

Summer gain/loss ratio	4.65	4.50	4.18	(P6)
External temperature (East Pennines)	14.6	16.9	16.9	
Thermal mass temperature increment (TMP = 283.0)	<u>0.02</u>	<u>0.02</u>	<u>0.02</u>	
Threshold temperature	19.27	21.42	21.10	(P7)
Likelihood of high internal temperature	Not sig.	Slight	Slight	

Assessment of likelihood of high internal temperature: **Slight**

SAP 2009 IMPROVEMENTS (Version 9.90, March 2010)
calculated by program bsap2009 version 5.34q, printed on 07 Jun 2012 at 12:39

Filename: EW-1a-detached.bsp (File saved: 29 Aug 2011 11:37)

1a-detached

BD8 7LL

Current energy efficiency rating: **C 80**
Current environmental impact rating: **B 82**

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Recommended
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
L		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
Q		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic (PV) panels	Recommended
V	Wind turbine	Recommended

<u>Recommended measures:</u>	<u>SAP change</u>	<u>Cost change</u>	<u>CO2 change</u>
E Low energy lighting	+ 1.3	-£ 31	-116 kg (6.1%)
N Solar water heating	+ 1.2	-£ 28	-180 kg (10.1%)
U Solar photovoltaic	+ 8.9	-£ 219	-908 kg (56.8%)
V Wind turbine	+ 3.2	-£ 78	-324 kg (46.9%)

	<u>Typical annual savings</u>	Energy efficiency	Environmental impact
<u>Lower cost measures</u>			
Low energy lighting	£31 1.16 kg/m ²	B 82	B 84
Sub Total	£31 1.16 kg/m ²		
<u>Higher cost measures</u>			
(none)			
Sub Total	£31 1.16 kg/m ²		

Potential energy efficiency rating: **B 82**
Potential environmental impact rating: **B 84**

Further improvements to achieve even higher standards

Solar water heating	£28	1.80 kg/m ²	B 83	B 85
Solar photovoltaic	£219	9.08 kg/m ²	A 92	A 94
Wind turbine	£78	3.24 kg/m ²	A 95	A 97
Total Savings	£355	15.28 kg/m ²		

Enhanced energy efficiency rating:**A 95**

Enhanced environmental impact rating:

A 97

Fuel prices for cost data on this page from database revision number 322 TEST (03 Apr 2012)
 Recommendation texts revision number 3.0 (01 Mar 2011)

Typical heating and lighting costs of this home (per year):

	<u>Current</u>	<u>Potential</u>	<u>Enhanced</u>
Electricity	£110	£74	£83
Mains gas	£360	£365	£328
Space heating:	£291	£296	£296
Water heating:	£91	£91	£63
Lighting:	£87	£51	£51
Generated (PV):	-£0	-£0	-£219
Generated (wind):	-£0	-£0	-£78
Total cost	£470	£439	£115
Carbon dioxide emissions	1.9 tonnes		1.8 tonnes
1.5 tonnes			
Primary energy	100 kWh/m ²	93 kWh/m ²	84 kWh/m ²