Project Information

Building type End-terrace house

Reference

Date

Project 327 Greystoke Avenue
Bristol
BS10 6BD

SAP 2009 worksheet for New extension to existing dwelling - calculation of energy ratings

1. Overall dwelling dimensions

	Area (m^2)	**Av. Storey height (m)**	**Volume (m^3)**	
Ground floor (1)	41.00	2.40	98.40	(3a)
Ground floor (2)	20.00	2.40	48.00	(3b)
First floor	41.00	2.70	110.70	(3c)
Second floor	24.00	1.80	43.20	(3d)
	126.00			**(4)**
			300.30	**(5)**

2. Ventilation rate

			m³ per hour	
	main + seondary + other heating			
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	3	x 10	30.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

		Air changes per hour	
		0.10	**(8)**
Pressure test, assumed q50	15.00		(17)
Air permeability		0.85	(18)
		2.00	**(19)**
		0.85	**(20)**
Infiltration rate incorporating shelter factor		0.72	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7											
5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10

54.10 (22)

Wind Factor

1.35	1.27	1.27	1.13	1.02	0.97	0.93	0.93	1.05	1.13	1.20	1.27

13.53 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.98	0.92	0.92	0.81	0.74	0.70	0.67	0.67	0.76	0.81	0.87	0.92

9.77 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.98	0.92	0.92	0.83	0.77	0.75	0.72	0.72	0.79	0.83	0.88	0.92	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg			**1.730**	**1.50 (1.60)**	2.60			(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) dg			**1.730**	**1.50 (1.60)**	2.60			(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg			**1.260**	**1.50 (1.60)**	1.89			(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg			**1.260**	**1.50 (1.60)**	1.89			(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East) dg			**0.630**	**1.94 (2.10)**	1.22			(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg			**0.660**	**1.94 (2.10)**	1.28			(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg			**1.880**	**1.94 (2.10)**	3.64			(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg			**1.880**	**1.94 (2.10)**	3.64			(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) dg			**1.250**	**1.94 (2.10)**	2.42			(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) dg			**1.880**	**1.94 (2.10)**	3.64			(27)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) dg			**3.700**	**1.94 (2.10)**	7.17			(27)
Solid door dg			**1.890**	**2.10**	3.97			(26)
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg			**3.670**	**2.10**	7.71			(26)
Pitched roofs insulated between joists			37.00	0.11	4.07	9.00	333.00	(30)

4. Water heating energy requirements **kWh/year**

Assumed occupancy, N 2.88 (42)

Annual average hot water usage in litres per day Vd,average 108.10 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month												
118.90	114.58	110.26	105.93	101.61	97.29	97.29	101.61	105.93	110.26	114.58	118.90	(44)
Energy content of hot water used												
176.75	154.59	159.52	139.08	133.45	115.15	106.71	122.45	123.91	144.41	157.63	171.18	

Energy content (annual) 1704.83 (45)

Distribution loss												
26.51	23.19	23.93	20.86	20.02	17.27	16.01	18.37	18.59	21.66	23.64	25.68	(46)

Cylinder volume, l 210.00 (47)

Manufacturer's declared cylinder loss factor (kWh/day) 1.91 (47)

Temperature Factor 0.5400 (48)

Energy lost from hot water cylinder (kWh/day) 1.03 (55)

Total storage loss												
31.97	28.88	31.97	30.94	31.97	30.94	31.97	31.97	30.94	31.97	30.94	31.97	(56)
Net storage loss												
31.97	28.88	31.97	30.94	31.97	30.94	31.97	31.97	30.94	31.97	30.94	31.97	(57)

Primary circuit loss (annual) 360.00 (58)

Primary loss												
30.58	27.62	30.58	29.59	30.58	29.59	30.58	30.58	29.59	30.58	29.59	30.58	(59)
Total heat required for water heating calculated for each month												
239.30	211.09	222.07	199.61	196.00	175.69	169.26	185.00	184.44	206.96	218.16	233.73	(62)
Output from water heater for each month, kWh/month												
239.30	211.09	222.07	199.61	196.00	175.69	169.26	185.00	184.44	206.96	218.16	233.73	(64)

2441.29 (64)

Heat gains from water heating, kWh/month												
108.81	96.60	103.08	94.67	94.41	86.71	85.52	90.75	89.63	98.05	100.84	106.96	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
173.03	173.03	173.03	173.03	173.03	173.03	173.03	173.03	173.03	173.03	173.03	173.03	(66)
Lighting gains												
69.83	62.02	50.44	38.19	28.54	24.10	26.04	33.85	45.43	57.68	67.32	71.77	(67)
Appliances gains												
437.06	441.60	430.17	405.84	375.12	346.26	326.97	322.44	333.87	358.20	388.91	417.78	(68)
Cooking gains												
55.19	55.19	55.19	55.19	55.19	55.19	55.19	55.19	55.19	55.19	55.19	55.19	(69)
Pumps and fans gains												
10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)
Losses e.g. evaporation (negative values)												
-115.35	-115.35	-115.35	-115.35	-115.35	-115.35	-115.35	-115.35	-115.35	-115.35	-115.35	-115.35	(71)
Water heating gains												
146.25	143.75	138.55	131.48	126.90	120.44	114.95	121.98	124.48	131.79	140.05	143.76	(72)
Total internal gains												
776.00	770.23	742.02	698.37	653.43	613.66	590.82	601.13	626.64	670.54	719.15	756.17	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg	0.9 x 1.730 10.73	0.63 x 0.70	0.77	5.6712
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) dg	0.9 x 1.730 47.32	0.63 x 0.70	0.77	25.0203
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg	0.9 x 1.260 10.73	0.63 x 0.70	0.77	4.1304
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg	0.9 x 1.260 10.73	0.63 x 0.70	0.77	4.1304
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East) dg	0.9 x 0.630 19.87	0.63 x 0.70	0.77	3.8262
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg	0.9 x 0.660 10.73	0.63 x 0.70	0.77	2.1636
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg	0.9 x 1.880 10.73	0.63 x 0.70	0.77	6.1629
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg	0.9 x 1.880 10.73	0.63 x 0.70	0.77	6.1629
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) dg	0.9 x 1.250 47.32	0.63 x 0.70	0.77	18.0783

Lighting calculations

	Area	g	FF x Shading

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) dg	0.9 x 1.880	47.32	0.63 x 0.70	0.77	27.1897	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) dg	0.9 x 3.700	47.32	0.63 x 0.70	0.77	53.5117	
Solid door dg	0.9 x 1.890	0.00	0.00 x 0.70	0.77	0.0000	
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg	0.9 x 3.670	10.73	0.63 x 0.70	0.77	12.0307	
Total solar gains, January					168.08	(83-1)

Solar gains

168.08	286.11	384.02	498.64	589.04	624.35	600.34	522.81	430.70	325.74	201.29	143.86	(83)

Total gains

944.08	1056.34	1126.04	1197.01	1242.47	1238.00	1191.17	1123.94	1057.34	996.28	920.44	900.03	(84)

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg	0.9 x 1.73	0.80	0.70 x 0.83	0.72
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) dg	0.9 x 1.73	0.80	0.70 x 0.83	0.72
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg	0.9 x 1.26	0.80	0.70 x 0.83	0.53
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg	0.9 x 1.26	0.80	0.70 x 0.83	0.53
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East) dg	0.9 x 0.63	0.80	0.70 x 0.83	0.26
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg	0.9 x 0.66	0.80	0.70 x 0.83	0.28
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg	0.9 x 1.88	0.80	0.70 x 0.83	0.79
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) dg	0.9 x 1.88	0.80	0.70 x 0.83	0.79
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) dg	0.9 x 1.25	0.80	0.70 x 0.83	0.52
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South) dg	0.9 x 1.88	0.80	0.70 x 0.83	0.79

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South)	0.9 x 3.70	0.80	0.70 x 0.83	1.55

dg
GL = 7.47 / 126.00 = 0.059
C1 = 0.500
C2 = 1.027
EI = 493

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)
Heating system responsiveness 1.00

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
12.17	12.39	12.39	12.82	13.08	13.21	13.33	13.33	13.02	12.82	12.61	12.39	
alpha												
1.81	1.83	1.83	1.85	1.87	1.88	1.89	1.89	1.87	1.85	1.84	1.83	
Utilisation factor for gains for living area												
0.96	0.95	0.93	0.90	0.84	0.75	0.62	0.64	0.81	0.90	0.95	0.96	(86)
Mean internal temperature in living area T1												
17.12	17.41	17.97	18.62	19.48	20.19	20.64	20.62	20.00	19.03	17.89	17.24	(87)
Temperature during heating periods in rest of dwelling Th2												
19.16	19.19	19.19	19.23	19.26	19.27	19.29	19.29	19.25	19.23	19.21	19.19	(88)
Utilisation factor for gains for rest of dwelling												
0.95	0.93	0.91	0.87	0.79	0.65	0.44	0.46	0.72	0.87	0.93	0.95	(89)
Mean internal temperature in the rest of dwelling T2												
15.81	16.10	16.66	17.33	18.17	18.82	19.17	19.17	18.66	17.73	16.60	15.94	(90)

Living area fraction (24.00 / 126.00) 0.19 (91)
Mean internal temperature (for the whole dwelling)

16.06	16.35	16.91	17.57	18.42	19.08	19.45	19.44	18.91	17.98	16.84	16.19	(92)
Apply adjustment to the mean internal temperature, where appropriate												
16.06	16.35	16.91	17.57	18.42	19.08	19.45	19.44	18.91	17.98	16.84	16.19	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.92	0.91	0.88	0.84	0.76	0.64	0.46	0.48	0.70	0.84	0.91	0.93	(94)
Useful gains												
872.88	958.86	991.71	1007.99	948.49	790.93	548.14	537.20	742.13	833.06	834.15	834.04	(95)
Monthly average external temperature												
4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(96)
Heat loss rate for mean internal temperature												
3323.7	3206.1	2855.9	2423.4	1797.22	1186.39	670.26	667.34	1240.33	1961.17	2733.0	3187.9	(97)
Space heating requirement for each month, kWh/month												
1823.37	1510.16	1386.94	1019.08	631.46	-	-	-	-	839.32	1367.14	1751.25	

Total space heating requirement per year (kWh/year) (October to May)	10328.71	(98)
Space heating requirement per m² (kWh/m²/year)	81.97	(99)

8c. Space cooling requirement - not applicable

9a. Energy requirements

kWh/year

No secondary heating system selected
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main heating system 92.70% (206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
1823.37	1510.16	1386.94	1019.08	631.46	-	-	-	-	839.32	1367.14	1751.25	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
1966.96	1629.08	1496.16	1099.33	681.18	-	-	-	-	905.41	1474.80	1889.15	(211)
Appendix Q - monthly energy saved (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating fuel (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
239.30	211.09	222.07	199.61	196.00	175.69	169.26	185.00	184.44	206.96	218.16	233.73	(64)
Efficiency of water heater												79.00 (216)
90.87	90.77	90.53	90.14	89.04	79.00	79.00	79.00	79.00	89.63	90.54	90.84	(217)
Water heating fuel												
263.34	232.55	245.29	221.44	220.12	222.39	214.25	234.17	233.47	230.91	240.96	257.28	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	11142.08	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	2816.17	(219)
Electricity for pumps, fans and electric keep-hot		
central heating pump	130.00	(230c)
boiler with a fan-assisted flue	45.00	(230e)
Total electricity for the above, kWh/year	175.00	(231)
Electricity for lighting (100.00% fixed LEL)	493.29	(232)
Energy saving/generation technologies		
PVs 0.80 x 2.000 x 913.000 x 1.000	1460.800	
PVs 0.80 x 0.000 x 0.000 x 0.500	0.000	
PVs 0.80 x 0.000 x 0.000 x 0.500	0.000	
	1460.800	(233)
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	13165.74	(238)

10a. Fuel costs using Table 12 prices

	kWh/year	Fuel price p/kWh	£/year	
Space heating - main system 1	11142.082	3.100	345.40	(240)
Space heating - main system 2	0.000	0.000	0.00	(241)
Water heating cost	2816.17	3.100	87.30	(247)
Mech vent fans cost	0.000	11.460	0.00	(249)
Pump/fan energy cost	175.000	11.460	20.05	(249)
Energy for lighting	493.286	11.460	56.53	(250)
Additional standing charges			106.00	(251)
Electricity generated - PVs	1460.800	11.460	-167.41	(252)
Appendix Q -				
Energy saved or generated ():	0.000	0.000	0.00	(253)
Energy used ():	0.000	0.000	0.00	(254)
Total energy cost			447.88	(255)

11a. SAP rating

	0.47	**(256)**
	1.23	**(257)**
SAP value	82.83	
	83	(258)
SAP band	**B**	

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	11142.08	0.198	2206.13	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.517	0.00	(263)
Water heating	2816.17	0.198	557.60	(264)
Space and water heating			2763.73	(265)
Electricity for pumps and fans	175.00	0.517	90.48	(267)
Electricity for lighting	493.29	0.517	255.03	(268)
Electricity generated - PVs	-1460.80	0.529	-772.76	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			2336.48	(272)

	kg/m²/year	
CO2 emissions per m²	**18.54**	(273)
EI value	81.69	(273a)
EI rating	**82**	(274)
EI band	**B**	

SAP 2009 worksheet for New extension to existing dwelling - calculation of energy ratings

13a. Primary energy

	Energy kWh/year	Primary factor	P. Energy (kWh/year)	
Space heating, main	11142.08	1.020	11364.92	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	2.920	0.00	(263)
Water heating	2816.17	1.020	2872.50	(264)
Space and water heating			14237.42	(265)
Electricity for pumps/fans	175.00	2.920	511.00	(267)
Electricity for lighting	493.29	2.920	1440.40	(268)
Electricity generated - PV	-1460.80	2.920	-4265.54	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Electricity generated - wind	0.00	2.920	0.00	(269)
New energy-saving technology :				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Primary energy kWh/year			**11923.28**	(272)
Primary energy kWh/m²/year			**94.63**	(273)

Project Information

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New extension to existing dwelling

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1 TER and DER

Fuel for main heating system: Gas (mains) (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 16.34	
Dwelling Carbon Dioxide Emission Rate	DER = 19.65	Fail

Excess emissions = 3.31kg/m² (20.3%)

2a Thermal bridging

Thermal bridging calculated using default y-value of 0.15

2b Fabric U-values

Element	Average	Highest	
Wall	0.80 (max. 0.30)	1.20 (max. 0.70)	Fail
Floor	0.30 (max. 0.25)	0.35 (max. 0.70)	Fail
Roof	0.14 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.96 (max. 2.00)	2.10 (max. 3.30)	OK

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3 Air permeability

Air permeability at 50 pascals:	15.00	Fail
Maximum :	10.00	

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4 Heating efficiency

Main heating system:

Boiler and radiators, mains gas
Worcester GREENSTAR

Source of efficiency: from boiler database
Worcester GREENSTAR 24Ri ErP+
Efficiency: 89.7% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None -

5 Cylinder insulation

Hot water storage

	Manufacturer's declared cylinder loss factor (kWh/day)	1.91	
	Permitted by DBSCG	2.30	OK
Primary pipework insulated	No		Fail

6 Controls

(Also refer to "Domestic Building Services Compliance Guide" by the DCLG)

Space heating controls	Programmer + roomstat + TRVs	OK
	Cylinderstat - Yes	OK
	Independent timer for DHW - Yes	OK
Boiler Interlock	Yes	OK

7 Low energy lights

	Percentage of fixed lights with low-energy fittings: 100.0%	
	Minimum: 75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Severn Valley):		OK
	Not significant	OK

Based on:

Thermal mass parameter :	100.00
Overshading :	Average or unknown (20-60 % sky blocked)

Orientation : South

Ventilation rate :	8.00

Blinds/curtains :

None with blinds/shutters closed 0.00% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K

Pitched roofs insulated between joists U-value 0.11 W/m²K

Photovoltaic array

Predicted Energy Assessment

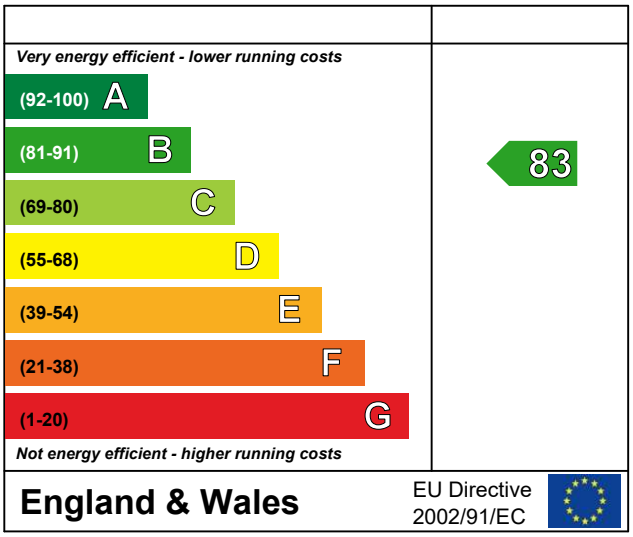
327 Greystoke Avenue
Bristol
BS10 6BD

Dwelling type: End-terrace house
Date of assessment: 11 February 2022
Produced by Complete Energy Consultancy Ltd
Total floor area: 126 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

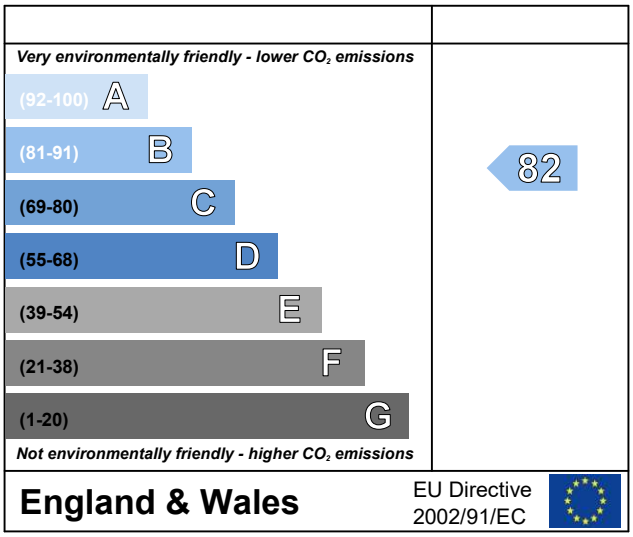
Energy performance has been assessed using the SAP 2009 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating



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 (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.