



SAP Calculations

Client: AFTAB RASHID

Project: PLOT 1 - 4 Thirlsfield Drive
Manchester, Greater Manchester, M11 4BF

Contact: Matthew Burgin
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Building Regulation Compliance

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Property Reference: 000009

Issued on Date: 12.Oct.2012

Survey Reference: 001

Prop Type Ref:
Property: PLOT 1, 4, Thirlsfield Drive, Manchester, Greater Manchester, M11 4BF,

SAP Rating: 90 B	CO2 Emissions (t/year): 1.12	DER: 10.58 Pass	Reduction: 42.4%	FEE: 59.3	ZC8: 0.00
Environmental: 91 B	General Requirements Compliance: Pass	TER: 18.37		HLP: 1.42	Energy cost: £ 275

CfSH Results	Version: CfSH November 2010	ENE1 Credits: 4.5	ENE2 Credits: 3.1	ENE7 Credits: 2	CfSH Level: 4
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Surveyor: Matthew Burgin, Tel: 0114 2570044

Address: Aizlewoods Mill, Nursery Street, Sheffield, South Yorkshire, s S3 8GG

Client: AFTAB RASHID, MAN01

Software Version: Elmhurst Energy Systems SAP2009 Calculator (Design System) version 3.07r18

SAP version: SAP 2009, Regs Region: England and Wales (Part L1A 2010), Calculation Type: New Dwelling As Designed

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

1 TER and DER

Fuel for main heating:	Mains gas	
Fuel factor:	1.00 (mains gas)	
Target Carbon Dioxide Emission Rate (TER)	18.37 kg/m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	10.58 kg/m ²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.71 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Design air permeability

Design air permeability at 50 pascals:	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Boiler system with radiators or underfloor - Mains gas Data from database Worcester Greenstar CDi 25 Cdi Combi boiler Efficiency: 90.0% SEDBUK2009 Minimum: 88.0%	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water storage	No cylinder
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6 Controls

Space heating controls:	Time and temperature zone control	OK
Hot water controls:	No cylinder	
Boiler interlock	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:	100%	
Minimum	75%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines):	Not significant	OK
Based On:		

Overshading:	Average
Windows facing North East:	10.45 m ² , No overhang
Windows facing South East:	1.44 m ² , No overhang
Windows facing South:	1.80 m ² , No overhang
Windows facing South West:	8.51 m ² , No overhang
Windows facing West:	1.80 m ² , No overhang
Windows facing North West:	2.15 m ² , No overhang
Ventilation rate:	8.00
Blinds/curtains:	None

10 Key features

External wall U-value	0.15 W/m ²
Roof U-value	0.11 W/m ²
Floor U-value	0.15 W/m ²
Photovoltaic array	

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Chimneys Other:	0
Chimneys Total:	0
Open Flues MHS:	0
Open Flues SHS:	0
Open Flues Other:	0
Open Flues Total:	0
Intermittent Fans:	4
Passive Vents:	0
Flueless Gas Fires:	0
Cooling System	None
Light Fittings:	30
LEL Fittings:	30
Percentage of LEL Fittings:	100
External Lights Fitted:	Yes
External LELs Fitted:	Yes
Electricity Tariff:	Standard
Main Heating 1	
Description	
Percentage	100
Sedbuk ID	10263
Fuel Type	Mains gas
MHS	BGW - Mains gas BGW Post 98 Combi condens. with auto ign.
SAP Code	104
Boiler Efficiency Type	Split Efficiencies
Efficiency Winter	90.9
Efficiency Summer	80.8
MHS Controls	CBI
Delayed Start Stat	No
Ctrl SAP Code	2110
Boiler Compensator	WeatherCompensator
Flue Type	Balanced
Fan Assisted Flue	Yes
Pumped	Pump in heated space
Heat Emitter	Radiators
Combi boiler type	Standard Combi
Combi keep hot type	None
Main Heating 2	None
Smoke Control Area	Unknown
Community Heating	None
Secondary Heating	None
Water Heating	
Type	MainHeating1
WHS	HWP -
Low Water Usage	Yes
SAP Code	901
Hot Water Cylinder	None
Flue Gas Heat Recovery System	None
Waste Water Heat Recovery	none
PV Unit	
Type	One Dwelling
PVUnit 1	Cells Peak = 2, Orientation = SouthWest, Elevation = _30, Overshading = NoneOrLittle
Wind Turbine	None
Terrain Type:	Urban
Small Scale Hydro	None
Special Features	None

CALCULATION DETAILS for survey reference no '001'
CALCULATION OF FABRIC ENERGY EFFICIENCY

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SAP 2009 WORKSHEET FOR New Build (As Designed) BRE SAP Worksheet 9.90
CALCULATION OF FABRIC ENERGY EFFICIENCY
Calculated by program Elmhurst Energy Systems SAP2009 Calculator (Design System) version 3.07r18

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	60.5000 (1b)	x	2.7500 (2b)	= 166.3750 (1b) - (3b)
First floor	60.5000 (1c)	x	2.5500 (2c)	= 154.2750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.0000			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 320.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1247 (8)
Pressure test					Yes
Measured/design q50					6.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.4247 (18)
Number of sides on which dwelling is sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3610 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.4000	5.1000	5.1000	5.1000	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)
(22b)m	0.4874	0.4603	0.4603	0.4062	0.3701	0.3520	0.3340	0.3340	0.3791	0.4062	0.4332	0.4603 (22b)
Effective ach	0.6188	0.6059	0.6059	0.5825	0.5685	0.5620	0.5558	0.5558	0.5719	0.5825	0.5938	0.6059 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Door			2.0000	1.8000	3.6000		(26)						
Windows (Uw = 1.70)			26.1500	1.5918	41.6245		(27)						
Heat Loss Floor 1			60.5000	0.1500	9.0750	110.0000	6655.0000 (28a)						
External Wall 1	169.6000	28.1500	141.4500	0.1500	21.2175	60.0000	8487.0000 (29a)						
External Roof 1	60.5000		60.5000	0.1100	6.6550	9.0000	544.5000 (30)						
Total net area of external elements Aum(A, m2)			290.6000				(31)						
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		82.1720		(33)						
Internal Partition 1			48.7900			75.0000	3659.2500 (32c)						
Internal Partition 2			67.1300			9.0000	604.1700 (32c)						
Internal Floor 1			60.5000			18.0000	1089.0000 (32d)						
Internal Ceiling 1			60.5000			18.0000	1089.0000 (32e)						
Internal Ceiling 2			60.5000			18.0000	1089.0000 (32e)						
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) = 23216.9200 (34)							
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							191.8754 (35)						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							29.7250 (36)						
Total fabric heat loss						(33) + (36) = 111.8970 (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	65.4757	64.1180	64.1180	61.6353	60.1526	59.4630	58.8079	58.8079	60.5104	61.6353	62.8378	64.1180	(38)
(39)m	177.3727	176.0150	176.0150	173.5323	172.0497	171.3600	170.7049	170.7049	172.4074	173.5323	174.7349	176.0150	(39)
(40)m	1.4659	1.4547	1.4547	1.4342	1.4219	1.4162	1.4108	1.4108	1.4249	1.4342	1.4441	1.4547	(40)
									Average = Sum(40)m / 12 =				1.4356 (40)
(41)m	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												2.8671 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												102.2935 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)												
(44)m	112.5229	108.4312	104.3394	100.2477	96.1559	92.0642	92.0642	96.1559	100.2477	104.3394	108.4312	112.5229 (44)
(45)m	167.2674	146.2931	150.9614	131.6118	126.2847	108.9741	100.9805	115.8766	117.2605	136.6559	149.1705	161.9896 (45)
Energy content (annual)										Total = Sum(45)m =		1613.3262 (45)
(46)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
(57)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary circuit loss (annual) from Table 3												0.0000 (58)
(59)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
(65)m	35.5443	31.0873	32.0793	27.9675	26.8355	23.1570	21.4584	24.6238	24.9179	29.0394	31.6987	34.4228 (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	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548 (66)
(67)m	25.5693	22.7105	18.4694	13.9825	10.4521	8.8241	9.5347	12.3936	16.6347	21.1216	24.6520	26.2800 (67)
(68)m	286.5094	289.4824	281.9904	266.0407	245.0071	226.9844	214.3428	211.3698	218.8618	234.8115	254.9451	273.8678 (68)
(69)m	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355 (69)
(70)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
(71)m	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839 (71)

(72)m	47.7746	46.2609	43.1173	38.8438	36.0692	32.1625	28.8419	33.0965	34.6081	39.0314	44.0260	46.2672 (72)
(73)m	425.8598	424.4602	409.5836	384.8734	358.4349	333.9774	318.7259	322.8663	336.1111	360.9709	389.6295	412.4214 (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	10.4500	11.5098	0.6300	0.7000	0.7700	36.7582 (75)
Southeast	1.4400	37.3877	0.6300	0.7000	0.7700	16.4537 (77)
South	1.8000	47.3233	0.6300	0.7000	0.7700	26.0327 (78)
Southwest	8.5100	37.3877	0.6300	0.7000	0.7700	97.2366 (79)
West	1.8000	19.8726	0.6300	0.7000	0.7700	10.9320 (80)
Northwest	2.1500	11.5098	0.6300	0.7000	0.7700	7.5627 (81)

(83)m	194.9759	348.1588	500.1679	683.8736	811.1997	849.0289	821.9187	721.8128	575.3103	406.7450	236.6743	164.7112 (83)
(84)m	620.8356	772.6190	909.7514	1068.7470	1169.6346	1183.0063	1140.6446	1044.6791	911.4214	767.7159	626.3039	577.1326 (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, n _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.3593	36.6397	36.6397	37.1639	37.4842	37.6351	37.7795	37.7795	37.4064	37.1639	36.9082	36.6397
alpha	3.4240	3.4426	3.4426	3.4776	3.4989	3.5090	3.5186	3.5186	3.4938	3.4776	3.4605	3.4426
(86)m	0.9961	0.9915	0.9802	0.9528	0.8811	0.7479	0.5658	0.6054	0.8593	0.9682	0.9933	0.9967 (86)
(87)m	18.9495	19.1745	19.5685	20.0019	20.4894	20.8097	20.9510	20.9394	20.6667	20.0819	19.3721	18.9889 (87)
(88)m	19.7168	19.7252	19.7252	19.7407	19.7500	19.7543	19.7584	19.7584	19.7477	19.7407	19.7332	19.7252 (88)
(89)m	0.9950	0.9891	0.9740	0.9373	0.8383	0.6539	0.4152	0.4494	0.7890	0.9543	0.9910	0.9957 (89)
(90)m	17.8679	18.0978	18.4885	18.9232	19.3874	19.6559	19.7455	19.7418	19.5505	19.0084	18.3016	17.9134 (90)
Living area fraction	f _{LA} = Living area / (4) =											
(92)m	18.0466	18.2758	18.6670	19.1015	19.5695	19.8466	19.9447	19.9398	19.7350	19.1858	18.4785	0.1653 (91)
Temperature adjustment												
(93)m	18.0466	18.2758	18.6670	19.1015	19.5695	19.8466	19.9447	19.9398	19.7350	19.1858	18.4785	18.0911 (92)
	0.0000											
	18.0911 (93)											

SAP 2009 WORKSHEET FOR New Build (As Designed) BRE SAP Worksheet 9.90
 CALCULATION OF DATA FOR RENEWABLE HEAT INCENTIVE (RHI)
 Calculated by program Elmhurst Energy Systems SAP2009 Calculator (Design System) version 3.07r18

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	60.5000 (1b)	x	2.7500 (2b)	= 166.3750 (1b) - (3b)
First floor	60.5000 (1c)	x	2.5500 (2c)	= 154.2750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.0000			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 320.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1247 (8)
Pressure test					Yes
Measured/design q50					6.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.4247 (18)
Number of sides on which dwelling is sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3292 (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)
(22b)m	0.4444	0.4197	0.4197	0.3703	0.3374	0.3209	0.3045	0.3045	0.3456	0.3703	0.3950	0.4197 (22b)
Effective ach	0.5987	0.5881	0.5881	0.5686	0.5569	0.5515	0.5464	0.5464	0.5597	0.5686	0.5780	0.5881 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Door			2.0000	1.8000	3.6000		(26)						
Windows (Uw = 1.70)			26.1500	1.5918	41.6245		(27)						
Heat Loss Floor 1			60.5000	0.1500	9.0750	110.0000	6655.0000 (28a)						
External Wall 1	169.6000	28.1500	141.4500	0.1500	21.2175	60.0000	8487.0000 (29a)						
External Roof 1	60.5000		60.5000	0.1100	6.6550	9.0000	544.5000 (30)						
Total net area of external elements Aum(A, m2)			290.6000				(31)						
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.1720		(33)						
Internal Partition 1			48.7900			75.0000	3659.2500 (32c)						
Internal Partition 2			67.1300			9.0000	604.1700 (32c)						
Internal Floor 1			60.5000			18.0000	1089.0000 (32d)						
Internal Ceiling 1			60.5000			18.0000	1089.0000 (32e)						
Internal Ceiling 2			60.5000			18.0000	1089.0000 (32e)						
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23216.9200 (34)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							191.8754 (35)						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							29.7250 (36)						
Total fabric heat loss						(33) + (36) =	111.8970 (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	63.3556	62.2269	62.2269	60.1630	58.9304	58.3571	57.8125	57.8125	59.2278	60.1630	61.1627	62.2269	(38)
(39)m	175.2526	174.1239	174.1239	172.0601	170.8275	170.2542	169.7095	169.7095	171.1249	172.0601	173.0597	174.1239	(39)
(40)m	1.4484	1.4390	1.4390	1.4220	1.4118	1.4071	1.4026	1.4026	1.4143	1.4220	1.4302	1.4390	(40)
									Average = Sum(40)m / 12 =				1.4232 (40)
(41)m	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												2.8671 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												102.2935 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)												
(44)m	112.5229	108.4312	104.3394	100.2477	96.1559	92.0642	92.0642	96.1559	100.2477	104.3394	108.4312	112.5229 (44)
(45)m	167.2674	146.2931	150.9614	131.6118	126.2847	108.9741	100.9805	115.8766	117.2605	136.6559	149.1705	161.9896 (45)
Energy content (annual)										Total = Sum(45)m =		1613.3262 (45)
(46)m	25.0901	21.9440	22.6442	19.7418	18.9427	16.3461	15.1471	17.3815	17.5891	20.4984	22.3756	24.2984 (46)
Water storage loss:												
(57)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
(61)m	50.9589	46.0274	50.9589	49.3151	49.0000	45.4015	46.9149	49.0000	49.3151	50.9589	49.3151	50.9589 (61)
(62)m	218.2263	192.3205	201.9203	180.9269	175.2847	154.3756	147.8954	164.8766	166.5756	187.6148	198.4856	212.9485 (62)
(63)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Water heat.	218.2263	192.3205	201.9203	180.9269	175.2847	154.3756	147.8954	164.8766	166.5756	187.6148	198.4856	212.9485 (64)
RHI water heating demand								Solar Input (sum of months) = Sum(63)m =				0.0000 (63)
(65)m	68.3561	60.1493	62.9344	56.0897	54.2397	47.5843	45.3047	50.7790	51.3179	58.1778	61.9280	212.9485 (64)
								Total per year (kWh/year) = Sum(64)m =				2201.4508 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258 (66)

(67)m	63.9233	56.7761	46.1735	34.9563	26.1302	22.0602	23.8369	30.9841	41.5867	52.8039	61.6300	65.7000 (67)
(68)m	427.6259	432.0633	420.8812	397.0757	367.0256	338.7827	319.9147	315.4773	326.6594	350.4649	380.5150	408.7579 (68)
(69)m	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697 (69)
(70)m	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)
(71)m	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839 (71)
(72)m	91.8765	89.5079	84.5892	77.9024	72.9028	66.0893	60.8935	68.2513	71.2749	78.1960	86.0111	89.5178 (72)
(73)m	705.8374	700.7590	674.0555	632.3459	588.4702	549.3438	527.0566	537.1242	561.9326	603.8764	650.5677	686.3873 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	10.4500	10.1817	0.6300	0.7000	0.7700	32.5169 (75)
Southeast	1.4400	33.0737	0.6300	0.7000	0.7700	14.5552 (77)
South	1.8000	41.8629	0.6300	0.7000	0.7700	23.0289 (78)
Southwest	8.5100	33.0737	0.6300	0.7000	0.7700	86.0170 (79)
West	1.8000	17.5796	0.6300	0.7000	0.7700	9.6706 (80)
Northwest	2.1500	10.1817	0.6300	0.7000	0.7700	6.6901 (81)

(83)m	172.4787	328.8167	494.8470	656.5186	806.9303	827.9088	788.0251	699.8063	545.5529	376.8373	215.1585	149.0244 (83)
(84)m	878.3160	1029.5757	1168.9024	1288.8646	1395.4004	1377.2525	1315.0817	1236.9306	1107.4855	980.7137	865.7262	835.4117 (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, n11,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.7991	37.0377	37.0377	37.4819	37.7524	37.8795	38.0011	38.0011	37.6868	37.4819	37.2654	37.0377
alpha	3.4533	3.4692	3.4692	3.4988	3.5168	3.5253	3.5334	3.5334	3.5125	3.4988	3.4844	3.4692
(86)m	0.9872	0.9779	0.9578	0.9195	0.8147	0.6873	0.5318	0.5690	0.8026	0.9363	0.9795	0.9884 (86)
(87)m	19.2887	19.4884	19.8224	20.1960	20.6401	20.8561	20.9574	20.9461	20.7379	20.2652	19.6835	19.3110 (87)
(88)m	19.7299	19.7370	19.7370	19.7499	19.7576	19.7612	19.7647	19.7647	19.7558	19.7499	19.7436	19.7370 (88)
(89)m	0.9836	0.9717	0.9456	0.8956	0.7581	0.5922	0.3980	0.4330	0.7233	0.9114	0.9727	0.9850 (89)
(90)m	17.5100	17.8024	18.2814	18.8142	19.4058	19.6556	19.7466	19.7404	19.5363	18.9241	18.0927	17.5473 (90)
Living area fraction												0.1653 (91)
(92)m	17.8040	18.0811	18.5361	19.0426	19.6098	19.8540	19.9468	19.9397	19.7350	19.1458	18.3556	17.8388 (92)
Temperature adjustment												0.0000
(93)m	17.8040	18.0811	18.5361	19.0426	19.6098	19.8540	19.9468	19.9397	19.7350	19.1458	18.3556	17.8388 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m	0.9752	0.9600	0.9299	0.8783	0.7502	0.6001	0.4190	0.4538	0.7217	0.8953	0.9616	0.9771 (94)
(95)m	856.5509	988.4162	1086.9136	1132.0541	1046.8967	826.4525	550.9892	561.2945	799.2796	878.0248	832.4965	816.3071 (95)
(96)m	5.1000	5.5000	7.0000	8.9000	12.0000	14.5000	16.6000	16.5000	14.1000	10.9000	7.6000	5.4000 (96)
(97)m	2226.4011	2190.6695	2008.7147	1745.1430	1299.9633	911.5478	567.9784	583.7477	964.2804	1418.7671	1861.3695	2165.8942 (97)
(98)m	1019.1685	807.9142	685.8200	441.4241	188.2815	0.0000	0.0000	0.0000	0.0000	402.3123	740.7886	1004.0928 (98)
Space heating (October to May) (kwh/year)												5289.8020 (98)
RHI space heating demand												5290 (98)

CALCULATION DETAILS for survey reference no '001'
CALCULATION OF ENERGY RATINGS

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SAP 2009 WORKSHEET FOR New Build (As Designed) BRE SAP Worksheet 9.90
CALCULATION OF ENERGY RATINGS
Calculated by program Elmhurst Energy Systems SAP2009 Calculator (Design System) version 3.07r18

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.5000 (1b)	x 2.7500 (2b)	= 166.3750 (1b) - (3b)
First floor	60.5000 (1c)	x 2.5500 (2c)	= 154.2750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	320.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1247 (8)
Pressure test					Yes
Measured/design q50					6.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.4247 (18)
Number of sides on which dwelling is sheltered					3 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3292 (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)
(22b)m	0.4444	0.4197	0.4197	0.3703	0.3374	0.3209	0.3045	0.3045	0.3456	0.3703	0.3950	0.4197 (22b)
Effective ach	0.5987	0.5881	0.5881	0.5686	0.5569	0.5515	0.5464	0.5464	0.5597	0.5686	0.5780	0.5881 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Door			2.0000	1.8000	3.6000		(26)						
Windows (Uw = 1.70)			26.1500	1.5918	41.6245		(27)						
Heat Loss Floor 1			60.5000	0.1500	9.0750	110.0000	6655.0000 (28a)						
External Wall 1	169.6000	28.1500	141.4500	0.1500	21.2175	60.0000	8487.0000 (29a)						
External Roof 1	60.5000		60.5000	0.1100	6.6550	9.0000	544.5000 (30)						
Total net area of external elements Aum(A, m2)			290.6000				(31)						
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		82.1720		(33)						
Internal Partition 1			48.7900			75.0000	3659.2500 (32c)						
Internal Partition 2			67.1300			9.0000	604.1700 (32c)						
Internal Floor 1			60.5000			18.0000	1089.0000 (32d)						
Internal Ceiling 1			60.5000			18.0000	1089.0000 (32e)						
Internal Ceiling 2			60.5000			18.0000	1089.0000 (32e)						
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23216.9200 (34)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							191.8754 (35)						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							29.7250 (36)						
Total fabric heat loss						(33) + (36) =	111.8970 (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	63.3556	62.2269	62.2269	60.1630	58.9304	58.3571	57.8125	57.8125	59.2278	60.1630	61.1627	62.2269	(38)
(39)m	175.2526	174.1239	174.1239	172.0601	170.8275	170.2542	169.7095	169.7095	171.1249	172.0601	173.0597	174.1239	(39)
(40)m	1.4484	1.4390	1.4390	1.4220	1.4118	1.4071	1.4026	1.4026	1.4143	1.4220	1.4302	1.4390	(40)
									Average = Sum(40)m / 12 =				1.4232 (40)
(41)m	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												2.8671 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												102.2935 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)												
(44)m	112.5229	108.4312	104.3394	100.2477	96.1559	92.0642	92.0642	96.1559	100.2477	104.3394	108.4312	112.5229 (44)
(45)m	167.2674	146.2931	150.9614	131.6118	126.2847	108.9741	100.9805	115.8766	117.2605	136.6559	149.1705	161.9896 (45)
Energy content (annual)										Total = Sum(45)m =		1613.3262 (45)
(46)m	25.0901	21.9440	22.6442	19.7418	18.9427	16.3461	15.1471	17.3815	17.5891	20.4984	22.3756	24.2984 (46)
Water storage loss:												
(57)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
(61)m	50.9589	46.0274	50.9589	49.3151	49.0000	45.4015	46.9149	49.0000	49.3151	50.9589	49.3151	50.9589 (61)
(62)m	218.2263	192.3205	201.9203	180.9269	175.2847	154.3756	147.8954	164.8766	166.5756	187.6148	198.4856	212.9485 (62)
(63)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Water heat.	218.2263	192.3205	201.9203	180.9269	175.2847	154.3756	147.8954	164.8766	166.5756	187.6148	198.4856	212.9485 (64)
(65)m	68.3561	60.1493	62.9344	56.0897	54.2397	47.5843	45.3047	50.7790	51.3179	58.1778	61.9280	66.6013 (65)
										Solar Input (sum of months) = Sum(63)m =		0.0000 (63)
										Total per year (kWh/year) = Sum(64)m =		2201.4508 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258 (66)
(67)m	63.9233	56.7761	46.1735	34.9563	26.1302	22.0602	23.8369	30.9841	41.5867	52.8039	61.6300	65.7000 (67)

(68)m	427.6259	432.0633	420.8812	397.0757	367.0256	338.7827	319.9147	315.4773	326.6594	350.4649	380.5150	408.7579	(68)
(69)m	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	(69)
(70)m	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)
(71)m	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	(71)
(72)m	91.8765	89.5079	84.5892	77.9024	72.9028	66.0893	60.8935	68.2513	71.2749	78.1960	86.0111	89.5178	(72)
(73)m	705.8374	700.7590	674.0555	632.3459	588.4702	549.3438	527.0566	537.1242	561.9326	603.8764	650.5677	686.3873	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	10.4500	11.5098	0.6300	0.7000	0.7700	36.7582 (75)
Southeast	1.4400	37.3877	0.6300	0.7000	0.7700	16.4537 (77)
South	1.8000	47.3233	0.6300	0.7000	0.7700	26.8327 (78)
Southwest	8.5100	37.3877	0.6300	0.7000	0.7700	97.2366 (79)
West	1.8000	19.8726	0.6300	0.7000	0.7700	10.9320 (80)
Northwest	2.1500	11.5098	0.6300	0.7000	0.7700	7.5627 (81)

(83)m	194.9759	348.1588	500.1679	683.8736	811.1997	849.0289	821.9187	721.8128	575.3103	406.7450	236.6743	164.7112	(83)
(84)m	900.8133	1048.9178	1174.2234	1316.2195	1399.6699	1398.3726	1348.9753	1258.9371	1137.2429	1010.6214	887.2420	851.0985	(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, n11,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	36.7991	37.0377	37.0377	37.4819	37.7524	37.8795	38.0011	38.0011	37.6868	37.4819	37.2654	37.0377
(86)m	0.9877	0.9787	0.9589	0.9186	0.8251	0.6737	0.4905	0.5201	0.7815	0.9329	0.9807	0.9888 (86)
(87)m	19.2151	19.4283	19.7970	20.1866	20.6102	20.8673	20.9692	20.9630	20.7686	20.2718	19.6103	19.2474 (87)
(88)m	19.7299	19.7370	19.7370	19.7499	19.7576	19.7612	19.7647	19.7647	19.7558	19.7499	19.7436	19.7370 (88)
(89)m	0.9843	0.9730	0.9472	0.8949	0.7721	0.5767	0.3541	0.3778	0.6962	0.9073	0.9745	0.9857 (89)
(90)m	17.4024	17.7148	18.2448	18.8001	19.3683	19.6660	19.7534	19.7508	19.5692	18.9319	17.9861	17.4544 (90)
Living area fraction												fLA = Living area / (4) =
(92)m	17.7020	17.9980	18.5014	19.0293	19.5736	19.8645	19.9544	19.9512	19.7675	19.1534	18.2546	17.7507 (91)
Temperature adjustment												0.0000
(93)m	17.7020	17.9980	18.5014	19.0293	19.5736	19.8645	19.9544	19.9512	19.7675	19.1534	18.2546	17.7507 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m	0.9761	0.9615	0.9315	0.8776	0.7629	0.5856	0.3761	0.4006	0.6972	0.8911	0.9638	0.9780 (94)
(95)m	879.3206	1008.5665	1093.8460	1155.0942	1067.7386	818.8774	507.3388	504.3699	792.8667	900.5568	855.0955	832.4110 (95)
(96)m	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)
(97)m	2313.6836	2263.2701	2037.4902	1777.2540	1345.0245	896.3094	518.3556	517.8155	935.6197	1437.2780	1947.7153	2237.6201 (97)
(98)m	1067.1660	843.1608	702.0713	447.9550	206.3007	0.0000	0.0000	0.0000	0.0000	399.3205	786.6863	1045.4755 (98)
Space heating (October to May) (kWh/year)												5498.1361 (98)
Space heating requirement in kWh/m2/year												(98) / (4) =
												45.4391 (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 %)	93.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating:	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(98)m	1067.1660	843.1608	702.0713	447.9550	206.3007	0.0000	0.0000	0.0000	0.0000	399.3205	786.6863	1045.4755 (98)
(211)m	1136.4920	897.9349	747.6797	477.0554	219.7025	0.0000	0.0000	0.0000	0.0000	425.2615	837.7915	1113.3925 (211)
(215)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Annual totals kWh/year												
Space heating fuel used, main system 1												5855.3100 (211)
Space heating fuel used, secondary												0.0000 (215)
Water heating												
(64)m	218.2263	192.3205	201.9203	180.9269	175.2847	154.3756	147.8954	164.8766	166.5756	187.6148	198.4856	212.9485 (64)
Efficiency of water heater												80.8000 (216)
(217)m	89.0110	88.8375	88.4309	87.7445	85.9640	80.8000	80.8000	80.8000	80.8000	87.4075	88.6670	89.0171 (217)
(219)m	245.1677	216.4857	228.3367	206.1974	203.9049	191.0589	183.0389	204.0552	206.1579	214.6438	223.8551	239.2220 (219)

Water heating fuel used	2562.1242 (219)
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Electricity for pumps, fans and electric keep-hot (Table 4f):	
central heating pump	130.0000 (230c)
boiler with a fan-assisted flue	45.0000 (230e)
Total electricity for the above, kWh/year	175.0000 (231)
Electricity for lighting (calculated in Appendix L)	451.5625 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 2.00 * 1027 * 1.00)	-1643.2000 (233)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5855.3100	3.1000	181.5146 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating cost (other fuel)	2562.1242	3.1000	79.4259 (247)
Pumps and fans for heating	175.0000	11.4600	20.0550 (249)

Energy for lighting	451.5625	11.4600	51.7491 (250)
Additional standing charges			106.0000 (251)
Energy saving/generation technologies			
PV Unit	-1643.2000	11.4600	-188.3107 (252)
Total energy cost			250.4338 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4700 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7091 (257)
SAP value		90.1086
SAP rating (Section 12)		90 (258)
SAP band		B

10a. Fuel costs - using BEDF prices (329)

	Fuel kwh/year	Fuel price p/kwh	Fuel cost £/year
Space heating - main system 1	5855.3100	3.4100	199.6661 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating cost (other fuel)	2562.1242	3.4100	87.3684 (247)
Pumps and fans for heating	175.0000	12.9300	22.6275 (249)
Energy for lighting	451.5625	12.9300	58.3870 (250)
Additional standing charges			119.0000 (251)
Energy saving/generation technologies			
PV Unit	-1643.2000	12.9300	-212.4658 (252)
Total energy cost			274.5833 (255)

12a. CO2 emissions - Individual heating systems including micro-CHP

	Energy kwh/year	Emission factor kg CO2/kwh	Emissions kg CO2/year
Space heating - main system 1	5855.3100	0.1980	1159.3514 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	2562.1242	0.1980	507.3006 (264)
Space and water heating			1666.6520 (265)
Pumps and fans	175.0000	0.5170	90.4750 (267)
Energy for lighting	451.5625	0.5170	233.4578 (268)
Energy saving/generation technologies			
PV Unit	-1643.2000	0.5290	-869.2528 (269)
Total CO2, kg/year			1121.3320 (272)
CO2 emissions per m2			9.2700 (273)
EI value			90.9483
EI rating			91 (274)
EI band			B

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	5855.3100	1.0200	5972.4162 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	2562.1242	1.0200	2613.3667 (264)
Space and water heating			8585.7829 (265)
Pumps and fans	175.0000	2.9200	511.0000 (267)
Energy for lighting	451.5625	2.9200	1318.5624 (268)
Energy saving/generation technologies			
PV Unit	-1643.2000	2.9200	-4798.1440 (269)
Primary energy kwh/year			5617.2014 (272)
Primary energy kwh/m2/year			46.4232 (273)

CALCULATION DETAILS for survey reference no '001'
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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SAP 2009 WORKSHEET FOR New Build (As Designed) BRE SAP Worksheet 9.90
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE
Calculated by program Elmhurst Energy Systems SAP2009 Calculator (Design System) version 3.07r18

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.5000 (1b)	x 2.7500 (2b)	= 166.3750 (1b) - (3b)
First floor	60.5000 (1c)	x 2.5500 (2c)	= 154.2750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	320.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1247 (8)
Pressure test					Yes
Measured/design q50					6.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.4247 (18)
Number of sides on which dwelling is sheltered					3 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3292 (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)
(22b)m	0.4444	0.4197	0.4197	0.3703	0.3374	0.3209	0.3045	0.3045	0.3456	0.3703	0.3950	0.4197 (22b)
Effective ach	0.5987	0.5881	0.5881	0.5686	0.5569	0.5515	0.5464	0.5464	0.5597	0.5686	0.5780	0.5881 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Door			2.0000	1.8000	3.6000		(26)						
Windows (Uw = 1.70)			26.1500	1.5918	41.6245		(27)						
Heat Loss Floor 1			60.5000	0.1500	9.0750	110.0000	6655.0000 (28a)						
External Wall 1	169.6000	28.1500	141.4500	0.1500	21.2175	60.0000	8487.0000 (29a)						
External Roof 1	60.5000		60.5000	0.1100	6.6550	9.0000	544.5000 (30)						
Total net area of external elements Aum(A, m2)			290.6000				(31)						
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		82.1720		(33)						
Internal Partition 1			48.7900			75.0000	3659.2500 (32c)						
Internal Partition 2			67.1300			9.0000	604.1700 (32c)						
Internal Floor 1			60.5000			18.0000	1089.0000 (32d)						
Internal Ceiling 1			60.5000			18.0000	1089.0000 (32e)						
Internal Ceiling 2			60.5000			18.0000	1089.0000 (32e)						
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23216.9200 (34)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							191.8754 (35)						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							29.7250 (36)						
Total fabric heat loss						(33) + (36) =	111.8970 (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	63.3556	62.2269	62.2269	60.1630	58.9304	58.3571	57.8125	57.8125	59.2278	60.1630	61.1627	62.2269	(38)
(39)m	175.2526	174.1239	174.1239	172.0601	170.8275	170.2542	169.7095	169.7095	171.1249	172.0601	173.0597	174.1239	(39)
(40)m	1.4484	1.4390	1.4390	1.4220	1.4118	1.4071	1.4026	1.4026	1.4143	1.4220	1.4302	1.4390	(40)
									Average = Sum(40)m / 12 =				1.4232 (40)
(41)m	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												2.8671 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												102.2935 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)												
(44)m	112.5229	108.4312	104.3394	100.2477	96.1559	92.0642	92.0642	96.1559	100.2477	104.3394	108.4312	112.5229 (44)
(45)m	167.2674	146.2931	150.9614	131.6118	126.2847	108.9741	100.9805	115.8766	117.2605	136.6559	149.1705	161.9896 (45)
Energy content (annual)										Total = Sum(45)m =		1613.3262 (45)
(46)m	25.0901	21.9440	22.6442	19.7418	18.9427	16.3461	15.1471	17.3815	17.5891	20.4984	22.3756	24.2984 (46)
Water storage loss:												
(57)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
(61)m	50.9589	46.0274	50.9589	49.3151	49.0000	45.4015	46.9149	49.0000	49.3151	50.9589	49.3151	50.9589 (61)
(62)m	218.2263	192.3205	201.9203	180.9269	175.2847	154.3756	147.8954	164.8766	166.5756	187.6148	198.4856	212.9485 (62)
(63)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Water heat.	218.2263	192.3205	201.9203	180.9269	175.2847	154.3756	147.8954	164.8766	166.5756	187.6148	198.4856	212.9485 (64)
(65)m	68.3561	60.1493	62.9344	56.0897	54.2397	47.5843	45.3047	50.7790	51.3179	58.1778	61.9280	66.6013 (65)
Solar Input (sum of months) = Sum(63)m =										0.0000 (63)		
Total per year (kWh/year) = Sum(64)m =										2201.4508 (64)		

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

Metabolic gains (Table 5), Watts												
(66)m	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548 (66)
(67)m	25.5693	22.7105	18.4694	13.9825	10.4521	8.8241	9.5347	12.3936	16.6347	21.1216	24.6520	26.2800 (67)

(68)m	286.5094	289.4824	281.9904	266.0407	245.9071	226.9844	214.3428	211.3698	218.8618	234.8115	254.9451	273.8678	(68)
(69)m	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	(69)
(70)m	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)
(71)m	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	(71)
(72)m	91.8765	89.5079	84.5892	77.9024	72.9028	66.0893	60.8935	68.2513	71.2749	78.1960	86.0111	89.5178	(72)
(73)m	479.9617	477.7073	461.0555	433.9320	405.2684	377.9042	360.7775	368.0211	382.7778	410.1355	441.6146	465.6721	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	10.4500	11.5098	0.6300	0.7000	0.7700	36.7582 (75)
Southeast	1.4400	37.3877	0.6300	0.7000	0.7700	16.4537 (77)
South	1.8000	47.3233	0.6300	0.7000	0.7700	26.0327 (78)
Southwest	8.5100	37.3877	0.6300	0.7000	0.7700	97.2366 (79)
West	1.8000	19.8726	0.6300	0.7000	0.7700	10.9320 (80)
Northwest	2.1500	11.5098	0.6300	0.7000	0.7700	7.5627 (81)

(83)m	194.9759	348.1588	500.1679	683.8736	811.1997	849.0289	821.9187	721.8128	575.3103	406.7450	236.6743	164.7112	(83)
(84)m	674.9375	825.8661	961.2234	1117.8056	1216.4682	1226.9331	1182.6962	1089.8340	958.0881	816.8805	678.2889	630.3833	(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, n11,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.7991	37.0377	37.0377	37.4819	37.7524	37.8795	38.0011	38.0011	37.6868	37.4819	37.2654	37.0377	
alpha	3.4533	3.4692	3.4692	3.4988	3.5168	3.5253	3.5334	3.5334	3.5125	3.4988	3.4844	3.4692	
(86)m	0.9950	0.9896	0.9766	0.9464	0.8692	0.7307	0.5475	0.5841	0.8425	0.9620	0.9914	0.9956 (86)	
(87)m	19.0206	19.2413	19.6298	20.0511	20.5226	20.8263	20.9565	20.9466	20.6952	20.1311	19.4335	19.0563 (87)	
(88)m	19.7299	19.7370	19.7370	19.7499	19.7576	19.7612	19.7647	19.7647	19.7558	19.7499	19.7436	19.7370 (88)	
(89)m	0.9935	0.9866	0.9695	0.9293	0.8240	0.6358	0.4004	0.4314	0.7682	0.9458	0.9886	0.9943 (89)	
(90)m	17.1201	17.4456	18.0089	18.6173	19.2654	19.6313	19.7480	19.7436	19.4959	18.7423	17.7317	17.1769 (90)	
Living area fraction	fLA = Living area / (4) =												0.1653 (91)
(92)m	17.4343	17.7425	18.2768	18.8543	19.4732	19.8288	19.9478	19.9425	19.6941	18.9719	18.0130	17.4875 (92)	
Temperature adjustment													0.0000
(93)m	17.4343	17.7425	18.2768	18.8543	19.4732	19.8288	19.9478	19.9425	19.6941	18.9719	18.0130	17.4875 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
(94)m	0.9892	0.9794	0.9574	0.9128	0.8114	0.6417	0.4238	0.4554	0.7637	0.9314	0.9822	0.9905	(94)		
(95)m	667.6796	808.8439	920.2869	1020.3490	987.0346	787.2683	501.2002	496.2576	731.6705	760.8127	666.2320	624.4063	(95)		
(96)m	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)		
(97)m	2266.7634	2218.7654	1998.3822	1747.1503	1327.8739	890.2237	517.2379	516.3351	923.0657	1406.0505	1905.9000	2191.7867	(97)		
(98)m	1189.7183	947.4672	802.1029	523.2969	253.5844	0.0000	0.0000	0.0000	0.0000	480.0569	892.5610	1166.1311	(98)		
Space heating (October to May) (kWh/year)													6254.9188	(98)	
Space heating requirement in kWh/m2/year													(98) / (4) =	51.6935	(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 %)												93.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m	1189.7183	947.4672	802.1029	523.2969	253.5844	0.0000	0.0000	0.0000	0.0000	480.0569	892.5610	1166.1311	(98)
(211)m	1267.0057	1009.0173	854.2097	557.2917	270.0580	0.0000	0.0000	0.0000	0.0000	511.2427	950.5442	1241.8861	(211)
(215)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Annual totals kWh/year													
Space heating fuel used, main system 1												6661.2554	(211)
Space heating fuel used, secondary												0.0000	(215)
Water heating													
(64)m	218.2263	192.3205	201.9203	180.9269	175.2847	154.3756	147.8954	164.8766	166.5756	187.6148	198.4856	212.9485	(64)
Efficiency of water heater												80.8000	(216)
(217)m	89.1723	89.0224	88.6709	88.0716	86.4817	80.8000	80.8000	80.8000	80.8000	87.8155	88.8789	89.1787	(217)
(219)m	244.7243	216.0362	227.7188	205.4316	202.6841	191.0589	183.0389	204.0552	206.1579	213.6465	223.3215	238.7885	(219)
Water heating fuel used												2556.6624	(219)

12a. CO2 emissions - Individual heating systems including micro-CHP

	Energy kwh/year	Emission factor kg CO2/kwh	Emissions kg CO2/year	
Space heating - main system 1	6661.2554	0.1980	1318.9286	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating cost (other fuel)	2556.6624	0.1980	506.2191	(264)
Space and water heating			1825.1477	(265)

Pumps and fans	175.0000	0.5170	90.4750 (267)
Energy for lighting	451.5625	0.5170	233.4578 (268)
Energy saving/generation technologies			
PV Unit	-1643.2000	0.5290	-869.2528 (269)
Total CO2, kg/year			1279.8277 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			10.5800 (273)

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

DER			10.5800 ZC1
Total Floor Area		TFA	121.0000
Assumed number of occupants		N	2.8671
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5290
CO2 emissions from appliances, equation (L14)			14.3017 ZC2
CO2 emissions from cooking, equation (L16)			1.5522 ZC3
Total CO2 emissions			26.4339 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			26.4339 ZC8

CALCULATION DETAILS for survey reference no '001'
CALCULATION OF TARGET EMISSIONS

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SAP 2009 WORKSHEET FOR New Build (As Designed) BRE SAP Worksheet 9.90
CALCULATION OF TARGET EMISSIONS
Calculated by program Elmhurst Energy Systems SAP2009 Calculator (Design System) version 3.07r18

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.5000 (1b)	x 2.7500 (2b)	= 166.3750 (1b) - (3b)
First floor	60.5000 (1c)	x 2.5500 (2c)	= 154.2750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	320.6500 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.0936 (8)
Pressure test					Yes
Measured/design q50					10.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.5936 (18)
Number of sides on which dwelling is sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.5045 (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)
(22b)m	0.6811	0.6433	0.6433	0.5676	0.5171	0.4919	0.4667	0.4667	0.5298	0.5676	0.6054	0.6433 (22b)
Effective ach	0.7320	0.7069	0.7069	0.6611	0.6337	0.6210	0.6089	0.6089	0.6403	0.6611	0.6833	0.7069 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Doors			1.8500	2.0000	3.7000		(26)
Windows (Uw = 2.00)			28.4000	1.8519	52.5926		(27)
Heat Loss Floor 1			60.5000	0.2500	15.1250		(28a)
External Wall 1	169.6000	30.2500	139.3500	0.3500	48.7725		(29a)
External Roof 1	60.5000		60.5000	0.1600	9.6800		(30)
Total net area of external elements Aum(A, m2)			290.6000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		129.8701		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (User defined value 0.110 * total exposed area)							31.9660 (36)
Total fabric heat loss						(33) + (36) =	161.8361 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul
(39)m	77.4515	74.8001	74.8001	69.9519	67.0564	65.7097	64.4303
(40)m	239.2876	236.6362	236.6362	231.7880	228.8925	227.5457	226.2663
	1.9776	1.9557	1.9557	1.9156	1.8917	1.8805	1.8700
(41)m	31	28	31	30	31	30	31
							Average = Sum(40)m / 12 = 30

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												2.8671 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												107.6774 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)												
(44)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(45)m	118.4452	114.1381	109.8310	105.5239	101.2168	96.9097	96.9097	101.2168	105.5239	109.8310	114.1381	118.4452 (44)
Energy content (annual)	176.0710	153.9928	158.9068	138.5388	132.9312	114.7096	106.2953	121.9754	123.4321	143.8483	157.0216	170.5153 (45)
(46)m	26.4106	23.0989	23.8360	20.7808	19.9397	17.2064	15.9443	18.2963	18.5148	21.5772	23.5532	25.5773 (46)
Water storage loss:												
b) If manufacturer declared cylinder loss factor is not known :												
Cylinder volume (litres) including any solar storage within same cylinder												150.0000 (50)
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0191 (51)
Volume factor from Table 2a												0.9283 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.4364 (55)
(57)m	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) from Table 3												610.0000 (58)
(59)m	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)
(62)m	272.4074	241.0063	255.2432	231.7676	229.2677	207.9383	202.6317	218.3118	216.6609	240.1847	250.2504	266.8517 (62)
(63)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Water heat.	272.4074	241.0063	255.2432	231.7676	229.2677	207.9383	202.6317	Solar input (sum of months) = Sum(63)m =				0.0000 (63)
(65)m	135.6127	120.8134	129.9056	120.6472	121.2688	112.7240	112.4123	218.3118	216.6609	240.1847	250.2504	266.8517 (64)
								Total per year (kWh/year) = Sum(64)m =				2832.5216 (64)
								117.6259	115.6242	124.8987	126.7927	133.7655 (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	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548 (66)

(67)m	43.4223	38.5673	31.3650	23.7453	17.7499	14.9852	16.1921	21.0471	28.2493	35.8690	41.8644	44.6291 (67)
(68)m	286.5094	289.4824	281.9904	266.0407	245.9071	226.9844	214.3428	211.3698	218.8618	234.8115	254.9451	273.8678 (68)
(69)m	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355 (69)
(70)m	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)
(71)m	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839 (71)
(72)m	182.2752	179.7819	174.6043	167.5655	162.9957	156.5610	151.0918	158.0994	160.5892	167.8746	176.1010	179.7923 (72)
(73)m	588.2132	583.8380	563.9662	533.3580	502.6591	474.5371	457.6332	466.5227	483.7068	514.5615	548.9169	574.2957 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d			Gains W
East						28.4000	19.8726	0.7200	0.7000	0.7700			197.1224 (76)
(83)m	197.1224	382.0793	610.6857	906.7233	1103.2242	1151.1582	1117.3295	972.4363	730.0997	465.3007	245.0744	162.6066	(83)
(84)m	785.3357	965.9173	1174.6519	1440.0813	1605.8833	1625.6953	1574.9626	1438.9589	1213.8065	979.8622	793.9913	736.9022	(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, n _{li} ,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	35.1158	35.5093	35.5093	36.2520	36.7106	36.9279	37.1367	37.1367	36.5989	36.2520	35.8884	35.5093
(86)m	0.9964	0.9925	0.9809	0.9496	0.8699	0.7314	0.5466	0.5868	0.8565	0.9705	0.9938	0.9968 (86)
(87)m	18.8647	19.0862	19.5055	19.9894	20.4996	20.8169	20.9541	20.9428	20.6594	20.0373	19.3099	18.9185 (87)
(88)m	19.3548	19.3694	19.3694	19.3963	19.4125	19.4201	19.4273	19.4273	19.4086	19.3963	19.3833	19.3694 (88)
(89)m	0.9950	0.9896	0.9730	0.9280	0.8103	0.6067	0.3562	0.3875	0.7613	0.9530	0.9910	0.9955 (89)
(90)m	17.4843	17.7149	18.1299	18.6178	19.0952	19.3444	19.4198	19.4175	19.2386	18.6751	17.9487	17.5485 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.1653 (91)
(92)m	17.7125	17.9416	18.3572	18.8445	19.3273	19.5878	19.6734	19.6696	19.4734	18.9003	18.1737	17.7749 (92)
Temperature adjustment												0.0000
(93)m	17.7125	17.9416	18.3572	18.8445	19.3273	19.5878	19.6734	19.6696	19.4734	18.9003	18.1737	17.7749 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m	0.9928	0.9858	0.9660	0.9180	0.8064	0.6221	0.3885	0.4215	0.7663	0.9451	0.9877	0.9936 (94)
(95)m	779.6962	952.2478	1134.7265	1322.0297	1294.9354	1011.3278	611.8608	606.5132	930.1398	926.0359	784.2590	732.1991 (95)
(96)m	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)
(97)m	3161.5863	3062.4482	2734.8618	2351.3708	1745.8389	1134.9520	627.5278	626.6774	1187.7753	1877.5486	2616.1674	3046.6725 (97)
(98)m	1772.1262	1418.0547	1190.5006	741.1256	335.4722	0.0000	0.0000	0.0000	0.0000	707.9255	1318.9741	1721.9682 (98)
Space heating (October to May) (kWh/year)												9206.1471 (98)
Space heating requirement in kWh/m ² /year										(98) / (4) =		76.0839 (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)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												78.9000 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating:												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(98)m	1772.1262	1418.0547	1190.5006	741.1256	335.4722	0.0000	0.0000	0.0000	0.0000	707.9255	1318.9741	1721.9682 (98)
(211)m	2021.4368	1617.5528	1357.9855	845.3904	382.6679	0.0000	0.0000	0.0000	0.0000	807.5195	1504.5332	1964.2223 (211)
(215)m	177.2126	141.8055	119.0501	74.1126	33.5472	0.0000	0.0000	0.0000	0.0000	70.7925	131.8974	172.1968 (215)
Annual totals kWh/year												
Space heating fuel used, main system 1												10501.3085 (211)
Space heating fuel used, secondary												920.6147 (215)
Water heating												
(64)m	272.4074	241.0063	255.2432	231.7676	229.2677	207.9383	202.6317	218.3118	216.6609	240.1847	250.2504	266.8517 (64)
Efficiency of water heater												68.8000 (216)
(217)m	77.2457	77.1021	76.7328	76.0221	74.1987	68.8000	68.8000	68.8000	68.8000	75.8515	76.9336	77.2345 (217)
(219)m	352.6504	312.5808	332.6389	304.8685	308.9916	302.2360	294.5228	317.3136	314.9141	316.6512	325.2810	345.5085 (219)
Water heating fuel used												3828.1574 (219)
Electricity for pumps, fans and electric keep-hot (Table 4f):												
central heating pump												130.0000 (230c)
boiler with a fan-assisted flue												45.0000 (230e)
Total electricity for the above, kWh/year												175.0000 (231)
Electricity for lighting (calculated in Appendix L)												766.8510 (232)

12a. CO2 emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	10501.3085	0.1940	2037.2538 (261)
Space heating - secondary	920.6147	0.4220	388.4994 (263)
Water heating cost (other fuel)	3828.1574	0.1940	742.6625 (264)
Space and water heating			3168.4158 (265)
Pumps and fans	175.0000	0.4220	73.8500 (267)
Energy for lighting	766.8510	0.4220	323.6111 (268)
Total CO2, kg/year			3565.8769 (272)
Emissions per m2 for space and water heating			26.7956 (272a)
Emissions per m2 for lighting			2.6745 (272b)
Target Carbon Dioxide Emission Rate (TER)			18.3700 (273)
= [(26.7956 * 1.00 * 1.0206) + (2.6745 * 1.2251)] * 0.60			

CALCULATION DETAILS for survey reference no '001'
CALCULATION OF STANDARD ENE7 CO2

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SAP 2009 WORKSHEET FOR New Build (As Designed) BRE SAP Worksheet 9.90
CALCULATION OF STANDARD ENE7 CO2
Calculated by program Elmhurst Energy Systems SAP2009 Calculator (Design System) version 3.07r18

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.5000 (1b)	x	2.7500 (2b) = 166.3750 (1b) - (3b)
First floor	60.5000 (1c)	x	2.5500 (2c) = 154.2750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	320.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1247 (8)
Pressure test					Yes
Measured/design q50					6.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.4247 (18)
Number of sides on which dwelling is sheltered					3 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3292 (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)
(22b)m	0.4444	0.4197	0.4197	0.3703	0.3374	0.3209	0.3045	0.3045	0.3456	0.3703	0.3950	0.4197 (22b)
Effective ach	0.5987	0.5881	0.5881	0.5686	0.5569	0.5515	0.5464	0.5464	0.5597	0.5686	0.5780	0.5881 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Door			2.0000	1.8000	3.6000		(26)					
Windows (Uw = 1.70)			26.1500	1.5918	41.6245		(27)					
Heat Loss Floor 1			60.5000	0.1500	9.0750	110.0000	6655.0000 (28a)					
External Wall 1	169.6000	28.1500	141.4500	0.1500	21.2175	60.0000	8487.0000 (29a)					
External Roof 1	60.5000		60.5000	0.1100	6.6550	9.0000	544.5000 (30)					
Total net area of external elements Aum(A, m2)			290.6000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		82.1720		(33)					
Internal Partition 1			48.7900			75.0000	3659.2500 (32c)					
Internal Partition 2			67.1300			9.0000	604.1700 (32c)					
Internal Floor 1			60.5000			18.0000	1089.0000 (32d)					
Internal Ceiling 1			60.5000			18.0000	1089.0000 (32e)					
Internal Ceiling 2			60.5000			18.0000	1089.0000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) = 23216.9200 (34)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							191.8754 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							29.7250 (36)					
Total fabric heat loss						(33) + (36) = 111.8970 (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	63.3556	62.2269	62.2269	60.1630	58.9304	58.3571	57.8125	57.8125	59.2278	60.1630	61.1627	62.2269 (38)
(39)m	175.2526	174.1239	174.1239	172.0601	170.8275	170.2542	169.7095	169.7095	171.1249	172.0601	173.0597	174.1239 (39)
(40)m	1.4484	1.4390	1.4390	1.4220	1.4118	1.4071	1.4026	1.4026	1.4143	1.4220	1.4302	1.4390 (40)
									Average = Sum(40)m / 12 =			1.4232 (40)
(41)m	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												2.8671 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												102.2935 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)												
(44)m	112.5229	108.4312	104.3394	100.2477	96.1559	92.0642	92.0642	96.1559	100.2477	104.3394	108.4312	112.5229 (44)
(45)m	167.2674	146.2931	150.9614	131.6118	126.2847	108.9741	100.9805	115.8766	117.2605	136.6559	149.1705	161.9896 (45)
Energy content (annual)										Total = Sum(45)m =		1613.3262 (45)
(46)m	25.0991	21.9440	22.6442	19.7418	18.9427	16.3461	15.1471	17.3815	17.5891	20.4984	22.3756	24.2984 (46)
Water storage loss:												
b) If manufacturer declared cylinder loss factor is not known :												
Cylinder volume (litres) including any solar storage within same cylinder												150.0000 (50)
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0191 (51)
Volume factor from Table 2a												0.9283 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.4364 (55)
(57)m	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) from Table 3												360.0000 (58)
(59)m	30.5753	27.6164	30.5753	29.5890	30.5753	29.5890	30.5753	30.5753	29.5890	30.5753	29.5890	30.5753 (59)
(62)m	242.3709	214.1286	226.0650	204.2927	201.3882	181.6549	176.0840	190.9801	189.9414	211.7594	221.8514	237.0931 (62)
(63)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Water heat.	242.3709	214.1286	226.0650	204.2927	201.3882	181.6549	176.0840	190.9801	189.9414	211.7594	221.8514	237.0931 (64)
(65)m	115.6992	102.9108	110.2775	101.9056	102.0725	94.3786	93.6588	98.6118	97.1338	105.5209	107.7439	113.9444 (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	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548	143.3548 (66)
(67)m	25.5693	22.7195	18.4694	13.9825	10.4521	8.8241	9.5347	12.3936	16.6347	21.1216	24.6520	26.2800 (67)
(68)m	286.5094	289.4824	281.9904	266.0407	245.9071	226.9844	214.3428	211.3698	218.8618	234.8115	254.9451	273.8678 (68)
(69)m	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355	37.3355 (69)
(70)m	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)
(71)m	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839 (71)
(72)m	155.5097	153.1411	148.2224	141.5356	137.1942	131.0813	125.8855	132.5427	134.9081	141.8292	149.6443	153.1510 (72)
(73)m	543.5949	541.3405	524.6887	497.5652	469.5599	442.8962	425.7696	432.3126	446.4110	473.7687	505.2478	529.3053 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	10.4500	11.5098	0.6300	0.7000	0.7700	36.7582 (75)
Southeast	1.4400	37.3877	0.6300	0.7000	0.7700	16.4537 (77)
South	1.8000	47.3233	0.6300	0.7000	0.7700	26.0327 (78)
Southwest	8.5100	37.3877	0.6300	0.7000	0.7700	97.2366 (79)
West	1.8000	19.8726	0.6300	0.7000	0.7700	10.9320 (80)
Northwest	2.1500	11.5098	0.6300	0.7000	0.7700	7.5627 (81)

(83)m	194.9759	348.1588	500.1679	683.8736	811.1997	849.0289	821.9187	721.8128	575.3103	406.7450	236.6743	164.7112 (83)
(84)m	738.5707	889.4993	1024.8566	1181.4388	1280.7596	1291.9251	1247.6882	1154.1254	1021.7213	880.5137	741.9221	694.0165 (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, n _{li} ,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.7991	37.0377	37.0377	37.4819	37.7524	37.8795	38.0011	38.0011	37.6868	37.4819	37.2654	37.0377
alpha	3.4533	3.4692	3.4692	3.4988	3.5168	3.5253	3.5334	3.5334	3.5125	3.4988	3.4844	3.4692
(86)m	0.9933	0.9870	0.9719	0.9380	0.8540	0.7086	0.5240	0.5583	0.8209	0.9533	0.9887	0.9941 (86)
(87)m	19.0759	19.2955	19.6810	20.0962	20.5553	20.8433	20.9621	20.9537	20.7236	20.1791	19.4881	19.1119 (87)
(88)m	19.7299	19.7370	19.7370	19.7499	19.7576	19.7612	19.7647	19.7647	19.7558	19.7499	19.7436	19.7370 (88)
(89)m	0.9914	0.9833	0.9634	0.9188	0.8058	0.6124	0.3810	0.4095	0.7421	0.9341	0.9850	0.9923 (89)
(90)m	18.0031	18.2260	18.6067	19.0185	19.4481	19.6825	19.7550	19.7525	19.5982	19.1067	18.4239	18.0443 (90)
Living area fraction	fLA = Living area / (4) =											
(92)m	18.1804	18.4028	18.7843	19.1967	19.6311	19.8744	19.9545	19.9510	19.7842	19.2839	18.5998	18.2208 (92)
Temperature adjustment	0.0000											
(93)m	18.1804	18.4028	18.7843	19.1967	19.6311	19.8744	19.9545	19.9510	19.7842	19.2839	18.5998	18.2208 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m	0.9881	0.9779	0.9549	0.9080	0.8000	0.6222	0.4044	0.4337	0.7442	0.9246	0.9801	0.9893 (94)
(95)m	729.7631	869.8504	978.6765	1072.7848	1024.5625	803.8817	504.5157	500.5204	760.3820	814.0890	727.1728	686.5859 (95)
(96)m	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)
(97)m	2397.5253	2333.7411	2086.7477	1806.0582	1354.8559	897.9849	518.3760	517.7880	938.4878	1459.7481	2007.4546	2319.4673 (97)
(98)m	1240.8151	983.7346	824.4050	527.9568	245.7383	0.0000	0.0000	0.0000	0.0000	480.3704	921.8029	1214.8638 (98)
Space heating (October to May) (kWh/year)	6439.6869 (98)											
Space heating requirement in kWh/m2/year	(98) / (4) = 53.2206 (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)	0.1000 (201)											
Fraction of space heat from main system(s)	0.9000 (202)											
Efficiency of main space heating system 1 (in %)	88.9000 (206)											
Efficiency of secondary/supplementary heating system, %	100.0000 (208)											
Space heating:												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(98)m	1240.8151	983.7346	824.4050	527.9568	245.7383	0.0000	0.0000	0.0000	0.0000	480.3704	921.8029	1214.8638 (98)
(211)m	1256.1682	995.9068	834.6057	534.4895	248.7790	0.0000	0.0000	0.0000	0.0000	486.3142	933.2088	1229.8959 (211)
(215)m	124.0815	98.3735	82.4405	52.7957	24.5738	0.0000	0.0000	0.0000	0.0000	48.0370	92.1803	121.4864 (215)
Annual totals kWh/year												
Space heating fuel used, main system 1	6519.3681 (211)											
Space heating fuel used, secondary	643.9687 (215)											
Water heating												
(64)m	242.3709	214.1286	226.0650	204.2927	201.3882	181.6549	176.0840	190.9801	189.9414	211.7594	221.8514	237.0931 (64)
Efficiency of water heater	78.8000 (216)											
(217)m	86.9134	86.7349	86.3164	85.6011	83.7820	78.8000	78.8000	78.8000	78.8000	85.3053	86.5592	86.9148 (217)
(219)m	278.8649	246.8770	261.9028	238.6566	240.3717	230.5265	223.4569	242.3606	241.0424	248.2371	256.3003	272.7879 (219)
Water heating fuel used	2981.3846 (219)											
Electricity for pumps, fans and electric keep-hot (Table 4f):												
central heating pump	130.0000 (230c)											
boiler with a fan-assisted flue	45.0000 (230e)											
Total electricity for the above, kWh/year	175.0000 (231)											
Electricity for lighting (calculated in Appendix L)	451.5625 (232)											

12a. CO2 emissions - Individual heating systems including micro-CHP

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
--------------------	-------------------------------	--------------------------

Space heating - main system 1	6519.3681	0.1980	1290.8349 (261)
Space heating - secondary	643.9687	0.5170	332.9318 (263)
Water heating cost (other fuel)	2981.3846	0.1980	590.3142 (264)
Space and water heating			2214.0809 (265)
Pumps and fans	175.0000	0.5170	90.4750 (267)
Energy for lighting	451.5625	0.5170	233.4578 (268)
Total CO2, kg/year			2538.0137 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			20.9800 (273)

CALCULATION DETAILS for survey reference no '001'
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING

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SAP 2009 WORKSHEET FOR New Build (As Designed) BRE SAP Worksheet 9.90
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING
Calculated by program Elmhurst Energy Systems SAP2009 Calculator (Design System) version 3.07r18

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.5000 (1b)	x 2.7500 (2b)	= 166.3750 (1b) - (3b)
First floor	60.5000 (1c)	x 2.5500 (2c)	= 154.2750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	320.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1247 (8)
Pressure test					Yes
Measured/design q50					6.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.4247 (18)
Number of sides on which dwelling is sheltered					3 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3292 (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)
(22b)m	0.4444	0.4197	0.4197	0.3703	0.3374	0.3209	0.3045	0.3045	0.3456	0.3703	0.3950	0.4197 (22b)
Effective ach	0.5987	0.5881	0.5881	0.5686	0.5569	0.5515	0.5464	0.5464	0.5597	0.5686	0.5780	0.5881 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Door			2.0000	1.8000	3.6000		(26)					
Windows (Uw = 1.70)			26.1500	1.5918	41.6245		(27)					
Heat Loss Floor 1			60.5000	0.1500	9.0750	110.0000	6655.0000 (28a)					
External Wall 1	169.6000	28.1500	141.4500	0.1500	21.2175	60.0000	8487.0000 (29a)					
External Roof 1	60.5000		60.5000	0.1100	6.6550	9.0000	544.5000 (30)					
Total net area of external elements Aum(A, m2)			290.6000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		82.1720		(33)					
Internal Partition 1			48.7900			75.0000	3659.2500 (32c)					
Internal Partition 2			67.1300			9.0000	604.1700 (32c)					
Internal Floor 1			60.5000			18.0000	1089.0000 (32d)					
Internal Ceiling 1			60.5000			18.0000	1089.0000 (32e)					
Internal Ceiling 2			60.5000			18.0000	1089.0000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) = 23216.9200 (34)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							191.8754 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							29.7250 (36)					
Total fabric heat loss						(33) + (36) = 111.8970 (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	63.3556	62.2269	62.2269	60.1630	58.9304	58.3571	57.8125	57.8125	59.2278	60.1630	61.1627	62.2269 (38)
(39)m	175.2526	174.1239	174.1239	172.0601	170.8275	170.2542	169.7095	169.7095	171.1249	172.0601	173.0597	174.1239 (39)
(40)m	1.4484	1.4390	1.4390	1.4220	1.4118	1.4071	1.4026	1.4026	1.4143	1.4220	1.4302	1.4390 (40)
									Average = Sum(40)m / 12 = 1.4232 (40)			
(41)m	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												2.8671 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												102.2935 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)												
(44)m	112.5229	108.4312	104.3394	100.2477	96.1559	92.0642	92.0642	96.1559	100.2477	104.3394	108.4312	112.5229 (44)
(45)m	167.2674	146.2931	150.9614	131.6118	126.2847	108.9741	100.9805	115.8766	117.2605	136.6559	149.1705	161.9896 (45)
Energy content (annual)										Total = Sum(45)m =		1613.3262 (45)
(46)m	25.0901	21.9440	22.6442	19.7418	18.9427	16.3461	15.1471	17.3815	17.5891	20.4984	22.3756	24.2984 (46)
Water storage loss:												
(57)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
(61)m	50.9589	46.0274	50.9589	49.3151	49.0000	45.4015	46.9149	49.0000	49.3151	50.9589	49.3151	50.9589 (61)
(62)m	218.2263	192.3205	201.9203	180.9269	175.2847	154.3756	147.8954	164.8766	166.5756	187.6148	198.4856	212.9485 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector performance ratio												2.5714 (H4)
Annual solar radiation per m2												1073.0000 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1802.6400 (H7)
Solar-to-load ratio												1.1173 (H8)
Utilisation factor												0.5914 (H9)
Collector performance factor												0.8796 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												102.2935 (H14)
Volume ratio Veff/V												0.7332 (H15)

Solar storage volume factor													0.9379 (H16)
Solar input													-879.4912 (H17)
(63)m	-26.1438	-42.5047	-68.7208	-93.9730	-118.0205	-121.4421	-121.0084	-103.8282	-78.0699	-55.2754	-31.0834	-21.6620 (63)	-881.7321 (63)
Water heat.	192.0825	149.8158	133.1995	86.9539	57.2642	32.9335	26.8871	61.0485	88.5057	132.3393	167.4022	191.2865 (64)	1319.7187 (64)
(65)m	68.3561	60.1493	62.9344	56.0897	54.2397	47.5843	45.3047	50.7790	51.3179	58.1778	61.9280	66.6013 (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	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258	172.0258 (66)	
(67)m	63.9233	56.7761	46.1735	34.9563	26.1302	22.0602	23.8369	30.9841	41.5867	52.8039	61.6300	65.7000 (67)	
(68)m	427.6259	432.0633	420.8812	397.0757	367.0256	338.7827	319.9147	315.4773	326.6594	350.4649	380.5150	408.7579 (68)	
(69)m	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697	55.0697 (69)	
(70)m	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)	
(71)m	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839	-114.6839 (71)	
(72)m	91.8765	89.5079	84.5892	77.9024	72.9028	66.0893	60.8935	68.2513	71.2749	78.1960	86.0111	89.5178 (72)	
(73)m	705.8374	700.7590	674.0555	632.3459	588.4702	549.3438	527.0566	537.1242	561.9326	603.8764	650.5677	686.3873 (73)	

6. Solar gains

[Jan]		Area	Solar flux										
		m2	Table 6a	Specific data	g	Specific data	FF	Access					Gains
			W/m2	or Table 6b		or Table 6c		factor					W
								Table 6d					
Northeast		10.4500	11.5098	0.6300		0.7000		0.7700				36.7582 (75)	
Southeast		1.4400	37.3877	0.6300		0.7000		0.7700				16.4537 (77)	
South		1.8000	47.3233	0.6300		0.7000		0.7700				26.0327 (78)	
Southwest		8.5100	37.3877	0.6300		0.7000		0.7700				97.2366 (79)	
West		1.8000	19.8726	0.6300		0.7000		0.7700				10.9320 (80)	
Northwest		2.1500	11.5098	0.6300		0.7000		0.7700				7.5627 (81)	

(83)m	194.9759	348.1588	500.1679	683.8736	811.1997	849.0289	821.9187	721.8128	575.3103	406.7450	236.6743	164.7112 (83)	
(84)m	900.8133	1048.9178	1174.2234	1316.2195	1399.6699	1398.3726	1348.9753	1258.9371	1137.2429	1010.6214	887.2420	851.0985 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.7991	37.0377	37.0377	37.4819	37.7524	37.8795	38.0011	38.0011	37.6868	37.4819	37.2654	37.0377	
alpha	3.4533	3.4692	3.4692	3.4988	3.5168	3.5253	3.5334	3.5334	3.5125	3.4988	3.4844	3.4692	
(86)m	0.9877	0.9787	0.9589	0.9186	0.8251	0.6737	0.4905	0.5201	0.7815	0.9329	0.9807	0.9888 (86)	
(87)m	19.2151	19.4283	19.7970	20.1866	20.6102	20.8673	20.9692	20.9630	20.7686	20.2718	19.6103	19.2474 (87)	
(88)m	19.7299	19.7370	19.7370	19.7499	19.7576	19.7612	19.7647	19.7647	19.7558	19.7499	19.7436	19.7370 (88)	
(89)m	0.9843	0.9730	0.9472	0.8949	0.7721	0.5767	0.3541	0.3778	0.6962	0.9073	0.9745	0.9857 (89)	
(90)m	17.4024	17.7148	18.2448	18.8001	19.3683	19.6660	19.7534	19.7508	19.5692	18.9319	17.9861	17.4544 (90)	
Living area fraction									fLA = Living area / (4) =			0.1653 (91)	
(92)m	17.7020	17.9980	18.5014	19.0293	19.5736	19.8645	19.9544	19.9512	19.7675	19.1534	18.2546	17.7507 (92)	
Temperature adjustment												0.0000	
(93)m	17.7020	17.9980	18.5014	19.0293	19.5736	19.8645	19.9544	19.9512	19.7675	19.1534	18.2546	17.7507 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m	0.9761	0.9615	0.9315	0.8776	0.7629	0.5856	0.3761	0.4006	0.6972	0.8911	0.9638	0.9780 (94)	
(95)m	879.3206	1008.5665	1093.8460	1155.0942	1067.7386	818.8774	507.3388	504.3699	792.8667	900.5568	855.0955	832.4110 (95)	
(96)m	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)	
(97)m	2313.6836	2263.2701	2037.4902	1777.2540	1345.0245	896.3094	518.3556	517.8155	935.6197	1437.2780	1947.7153	2237.6201 (97)	
(98)m	1067.1660	843.1608	702.0713	447.9550	206.3007	0.0000	0.0000	0.0000	0.0000	399.3205	786.6863	1045.4755 (98)	
Space heating (October to May) (kwh/year)												5498.1361 (98)	
Space heating requirement in kwh/m2/year												(98) / (4) =	45.4391 (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 %)													93.9000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m	1067.1660	843.1608	702.0713	447.9550	206.3007	0.0000	0.0000	0.0000	0.0000	399.3205	786.6863	1045.4755 (98)	
(211)m	1136.4920	897.9349	747.6797	477.0554	219.7025	0.0000	0.0000	0.0000	0.0000	425.2615	837.7915	1113.3925 (211)	
(215)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Annual totals kwh/year													
Space heating fuel used, main system 1													5855.3100 (211)
Space heating fuel used, secondary													0.0000 (215)
Water heating													
(64)m	192.0825	149.8158	133.1995	86.9539	57.2642	32.9335	26.8871	61.0485	88.5057	132.3393	167.4022	191.2865 (64)	
Efficiency of water heater													80.8000 (216)
(217)m	89.1992	89.2174	89.1235	89.0897	88.4966	80.8000	80.8000	80.8000	80.8000	88.1570	88.9491	89.1759 (217)	
(219)m	215.3410	167.9222	149.4551	97.6026	64.7078	40.7593	33.2761	75.5550	109.5368	150.1177	188.1999	214.5046 (219)	
Water heating fuel used													1506.9782 (219)
Electricity for pumps, fans and electric keep-hot (Table 4f):													
central heating pump													130.0000 (230c)
boiler with a fan-assisted flue													45.0000 (230e)

pump for solar water heating	75.0000 (230g)
Total electricity for the above, kWh/year	250.0000 (231)
Electricity for lighting (calculated in Appendix L)	451.5625 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 2.00 * 1027 * 1.00)	-1643.2000 (233)

10a. Fuel costs - using Table 12 prices

	Fuel kwh/year	Fuel price p/kwh	Fuel cost £/year
Space heating - main system 1	5855.3100	3.1000	181.5146 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating cost (other fuel)	1506.9782	3.1000	46.7163 (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)
Energy for lighting	451.5625	11.4600	51.7491 (250)
Additional standing charges			106.0000 (251)
Energy saving/generation technologies			
PV Unit	-1643.2000	11.4600	-188.3107 (252)
Total energy cost			226.3193 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4700 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.6408 (257)
SAP value		91.0611
SAP rating (Section 12)		91 (258)
SAP band		B

10a. Fuel costs - using BEDF prices (329)

	Fuel kwh/year	Fuel price p/kwh	Fuel cost £/year
Space heating - main system 1	5855.3100	3.4100	199.6661 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating cost (other fuel)	1506.9782	3.4100	51.3880 (247)
Pumps and fans for heating	175.0000	12.9300	22.6275 (249)
Pump for solar water heating	75.0000	12.9300	9.6975 (249)
Energy for lighting	451.5625	12.9300	58.3870 (250)
Additional standing charges			119.0000 (251)
Energy saving/generation technologies			
PV Unit	-1643.2000	12.9300	-212.4658 (252)
Total energy cost			248.3003 (255)

12a. CO2 emissions - Individual heating systems including micro-CHP

	Energy kwh/year	Emission factor kg CO2/kwh	Emissions kg CO2/year
Space heating - main system 1	5855.3100	0.1980	1159.3514 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	1506.9782	0.1980	298.3817 (264)
Space and water heating			1457.7331 (265)
Pumps and fans	250.0000	0.5170	129.2500 (267)
Energy for lighting	451.5625	0.5170	233.4578 (268)
Energy saving/generation technologies			
PV Unit	-1643.2000	0.5290	-869.2528 (269)
Total CO2, kg/year			951.1881 (272)
CO2 emissions per m2			7.8600 (273)
EI value			92.3217
EI rating			92 (274)
EI band			A

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	5855.3100	1.0200	5972.4162 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	1506.9782	1.0200	1537.1177 (264)
Space and water heating			7509.5340 (265)
Pumps and fans	250.0000	2.9200	730.0000 (267)
Energy for lighting	451.5625	2.9200	1318.5624 (268)
Energy saving/generation technologies			
PV Unit	-1643.2000	2.9200	-4798.1440 (269)
Primary energy kwh/year			4759.9524 (272)
Primary energy kwh/m2/year			39.3384 (273)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2010 Edition
 Calculated by program Elmhurst Energy Systems SAP2009 Calculator (Design System) version 3.07r18

New Build (As Designed)

1 TER and DER
 Fuel for main heating:Mains gas
 Fuel factor:1.00 (mains gas)
 Target Carbon Dioxide Emission Rate (TER) 18.37 kg/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 10.58 kg/m²OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.71 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging
 Thermal bridging calculated from linear thermal transmittances for each junction

3 Design air permeability
 Design air permeability at 50 pascals: 6.00
 Maximum 10.0 OK

4 Heating efficiency
 Main heating system: Boiler system with radiators or underfloor - Mains gas
 Data from database
 Worcester Greenstar Cdi 25 Cdi
 Combi boiler
 Efficiency: 90.0% SEDBUK2009
 Minimum: 88.0% OK
 Secondary heating system: None

5 Cylinder insulation
 Hot water storage No cylinder

6 Controls
 Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
 Percentage of fixed lights with low-energy fittings:100%
 Minimum 75% OK

8 Mechanical ventilation
 Not applicable

9 Summertime temperature
 Overheating risk (West Pennines): Not significant OK
 Based on:
 Overshading: Average
 Windows facing North East: 10.45 m², No overhang
 Windows facing South East: 1.44 m², No overhang
 Windows facing South: 1.80 m², No overhang
 Windows facing South West: 8.51 m², No overhang
 Windows facing West: 1.80 m², No overhang
 Windows facing North West: 2.15 m², No overhang
 Ventilation rate: 8.00
 Blinds/curtains: None

10 Key features
 External wall U-value 0.15 W/m²K
 Roof U-value 0.11 W/m²K
 Floor U-value 0.15 W/m²K
 Photovoltaic array

SAP 2009 OVERHEATING ASSESSMENT FOR New Build (As Designed) BRE SAP Worksheet 9.90
 Calculated by program Elmhurst Energy Systems SAP2009 Calculator (Design System) version 3.07r18

Overheating Calculation Input Data

Dwelling type Detached House
 Number of storeys 2
 Cross ventilation possible Yes
 Region West Pennines
 Front of dwelling faces South West
 Overshading Average or unknown
 Thermal mass parameter 191.9 (calculated from construction elements)
 Night ventilation Yes
 Ventilation rate during hot weather (ach) 8.00 (windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient 846.52 (P1)
 Transmission heat loss coefficient 111.90 (37)
 Summer heat loss coefficient 958.41 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South East	0.000	1.000	None
South	0.000	1.000	None
South West	0.000	1.000	None
West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Shading	Gains W
North East	10.4500	89.1450	0.6300	0.7000	0.9000	332.7646
South East	1.4400	108.1397	0.6300	0.7000	0.9000	55.6252
South	1.8000	102.7194	0.6300	0.7000	0.9000	66.0463
South West	8.5100	108.1397	0.6300	0.7000	0.9000	328.7293
West	1.8000	107.9967	0.6300	0.7000	0.9000	69.4395
North West	2.1500	89.1450	0.6300	0.7000	0.9000	68.4635
total:						921.0683

	Jun	Jul	Aug	
Solar gains	968	921	818	(P3)
Internal gains	539	517	527	
Total summer gains	1507	1438	1345	(P5)
Summer gain/loss ratio	1.57	1.50	1.40	(P6)
Summer external temperature	14.50	16.60	16.50	
Thermal mass temperature increment (TMP = 191.9)	0.00	0.00	0.00	
Threshold temperature	16.73	18.76	18.56	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

SAP 2009 IMPROVEMENTS

Calculated by program Elmhurst Energy Systems SAP2009 Calculator (Design System) version 3.07r18

000009

Current energy efficiency rating: B 90
 Current environmental impact rating: B 91

(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
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	Already installed
V Wind turbine	SAP increase too small

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 26	-170 kg (15.2%)

Measures omitted - SAP change or cost saving too small:			
V Wind turbine	+ 0.3	-£ 8	-33 kg (2.9%)

	Typical annual savings	Energy efficiency	Environmental impact
Lower cost measures (none)			
Sub Total	£0	0.0000 kg/m²	
Higher cost measures (none)			
Sub Total	£0	0.0000 kg/m²	

Potential energy efficiency rating: B 90
 Potential environmental impact rating: B 91

Further improvements to achieve even higher standards			
Solar water heating	£26	1.4061 kg/m²	B 91 A 92
Total Savings	£26	1.4061 kg/m²	

Enhanced energy efficiency rating: B 91
 Enhanced environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 329 TEST (28 Sep 2012)
 Recommendation texts revision number 3.9c (09 Jan 2012)

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

	Current	Potential	Enhanced
Electricity	£81	£81	£91
Mains gas	£406	£406	£370
Space heating	£341	£341	£341
Water heating	£87	£87	£61
Lighting	£58	£58	£58
Generated (PV)	-£212	-£212	-£212
Total cost	£275	£275	£248
Carbon dioxide emissions	1.1 tonnes	1.1 tonnes	1.0 tonnes
Primary energy	46 kWh/m²	46 kWh/m²	39 kWh/m²

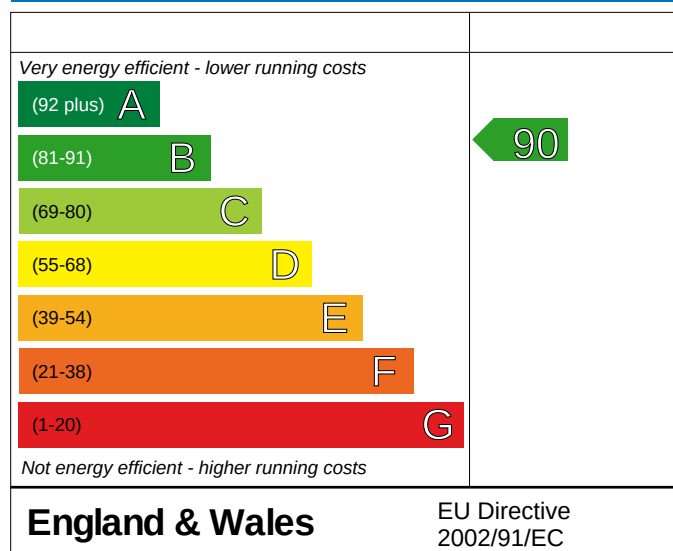
PLOT 1, 4, Thirlsfield Drive,
Manchester,
Greater Manchester,
M11 4BF

Dwelling type: House, Detached
Date of assessment: 12.Oct.2012
Produced by: MBAS (South Yorkshire) LTD
Total floor area: 121 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.

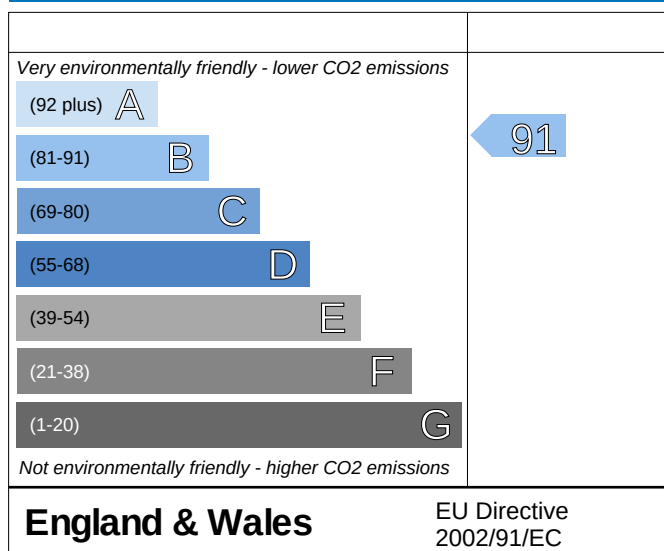
The energy performance has been assessed using the Government approved SAP2009 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



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



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.