



SAP Calculations

Client: Nick Jones

Project: Barn Boathouse, Salterns Quay
Hayling Island, Mengham, Hampshire

Contact: Surecalc Ltd
Mark Rogers MRICS MCABE CBuildE
surecalc@btinternet.com

Building Regulation Compliance

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Property Reference: sc0232

Issued on Date: 07.Sep.2015

Survey Reference: 001

Prop Type Ref: New Dwelling

Property: Barn Boathouse, Salterns Quay, Mengham, Hayling Island, Hampshire

SAP Rating: 83 B	CO2 Emissions (t/year): 2.38	DER: 16.70 Pass	Reduction: 1.1%	FEE: 58.7	ZC8: 0.00
Environmental: 84 B	General Requirements Compliance: Pass	TER: 16.89		HLP: 1.43	Energy cost: £ 638

CfSH Results	Version:	ENE1 Credits: N/A	ENE2 Credits: N/A	ENE7 Credits: N/A	CfSH Level: N/A
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Surveyor: Mark Rogers, Tel: 023 9225 4347

Surveyor ID: A320-0001

Address: 2 St Jacques Way, Denmead, Waterlooville, Hants, PO7 6LA

Client: Martin Critchley Consultants

Software Version: Elmhurst Energy Systems SAP2009 Calculator (Design System) version 4.03r03

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)	16.89 kg/m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.70 kg/m ²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.30 (max. 0.30)	0.33 (max. 0.70)	OK
Floor	0.21 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.62 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	9.00 (design value)	
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:	75%	
Minimum	75%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England):	Slight	OK
Based On:		

Overshading:	Average
Windows facing North East:	9.02 m ² , No overhang
Windows facing South East:	13.67 m ² , No overhang
Windows facing South West:	5.95 m ² , No overhang
Windows facing North West:	0.95 m ² , No overhang
Ventilation rate:	8.00
Blinds/curtains:	None

10 Key features

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External Lights Fitted:	Yes
External LELs Fitted:	Yes
Electricity Tariff:	Standard
Main Heating 1	
Description	Gas Condensing Combi
Percentage	100
Sedbuk ID	10263
Fuel Type	Mains gas
MHS	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 Time and temperature zone control
Delayed Start Stat	Yes
Ctrl SAP Code	2110
Boiler Compensator	None
Flue Type	Balanced
Fan Assisted Flue	Yes
Pumped	No pump
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 From main heating 1
Low Water Usage	Yes
SAP Code	901
Hot Water Cylinder	None
Flue Gas Heat Recovery System	None
Waste Water Heat Recovery	none
PV Unit	None
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 Design SAP 2009 version 4.03r03

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	76.5200 (1b)	x 2.3300 (2b)	= 178.2916 (1b) - (3b)
First floor	74.1000 (1c)	x 2.0600 (2c)	= 152.6460 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	330.9376 (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) = 0.1209 (8)
Pressure test					Yes
Measured/design q50					9.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.5709 (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) =	0.4852 (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	0.6551	0.6187	0.6187	0.5459	0.4974	0.4731	0.4488	0.4488	0.5095	0.5459	0.5823	0.6187 (22b)
Effective ach	0.7146	0.6914	0.6914	0.6490	0.6237	0.6119	0.6007	0.6007	0.6298	0.6490	0.6695	0.6914 (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			3.7900	1.8000	6.8220		(26)					
Windows (Uw = 1.60)			24.7900	1.5038	37.2782		(27)					
Rooflights (Uw = 1.60)			4.8000	1.5038	7.2180		(27a)					
Ground Floor			76.5200	0.2100	16.0692		(28a)					
Over Boathouse			18.4600	0.2200	4.0612		(28b)					
External Wall	104.4800	26.6700	77.8100	0.2900	22.5649		(29a)					
Semi Exposed Garage	14.0500	1.9100	12.1400	0.2628	3.1905		(29a)					
Perimeter Stud	32.0200		32.0200	0.2833	9.0700		(29a)					
External Roof	55.2200		55.2200	0.1500	8.2830		(30)					
Skilling Roof	58.9400	4.8000	54.1400	0.1500	8.1210		(30)					
Total net area of external elements Aum(A, m2)			359.6900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	122.6781		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.2058 (36)					
Total fabric heat loss						(33) + (36) =	142.8839 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	78.0366	75.5054	75.5054	70.8769	68.1126	66.8269	65.6055	65.6055	68.7796	70.8769	73.1188	75.5054 (38)
(39)m	220.9205	218.3893	218.3893	213.7608	210.9965	209.7108	208.4894	208.4894	211.6635	213.7608	216.0027	218.3893 (39)
(40)m	1.4667	1.4499	1.4499	1.4192	1.4009	1.3923	1.3842	1.3842	Average = Sum(39)m / 12 =		214.0802 (39)	
									1.4053	1.4192	1.4341	1.4499 (40)
(41)m	31	28	31	30	31	30	31	31	Average = Sum(40)m / 12 =		1.4213 (40)	
									30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												2.9352 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												103.9099 (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	114.3008	110.1444	105.9881	101.8317	97.6753	93.5189	93.5189	97.6753	101.8317	105.9881	110.1444	114.3008 (44)
(45)m	169.9104	148.6047	153.3467	133.6914	128.2801	110.6959	102.5761	117.7075	119.1133	138.8151	151.5275	164.5491 (45)
Energy content (annual)										Total = Sum(45)m =		1638.8179 (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	36.1060	31.5785	32.5862	28.4094	27.2595	23.5229	21.7974	25.0129	25.3116	29.4982	32.1996	34.9667 (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	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576 (66)
(67)m	28.7942	25.5747	20.7988	15.7460	11.7703	9.9370	10.7373	13.9567	18.7327	23.7854	27.7611	29.5944 (67)
(68)m	321.1962	324.5292	316.1301	298.2495	275.6784	254.4647	240.2927	236.9597	245.3588	263.2394	285.8105	307.0242 (68)
(69)m	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758 (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	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061 (71)

(72)m	48.5295	46.9918	43.7986	39.4575	36.6391	32.6707	29.2976	33.6194	35.1550	39.6481	44.7217	46.9982 (72)
(73)m	465.5471	464.1230	447.7548	420.4803	391.1151	364.0997	347.3548	351.5631	366.2737	393.7002	425.3206	450.6441 (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	6.0200	11.5098	0.6300	0.7000	0.7700	21.1755 (75)
Southeast	13.6700	37.3877	0.6300	0.7000	0.7700	156.1956 (77)
Southwest	4.1500	37.3877	0.6300	0.7000	0.7700	47.4186 (79)
Northwest	0.9500	11.5098	0.6300	0.7000	0.7700	3.3417 (81)
Horizontal	4.8000	26.0000	0.6300	0.7000	1.0000	49.5331 (82)

(83)m	277.6645	500.1541	725.3281	993.7888	1170.4194	1217.1520	1181.9123	1046.7765	836.0719	586.6868	337.9294	233.9459 (83)
(84)m	743.2116	964.2772	1173.0829	1414.2690	1561.5345	1581.2516	1529.2671	1398.3396	1202.3456	980.3871	763.2500	684.5900 (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	18.9384	19.1579	19.1579	19.5728	19.8292	19.9508	20.0676	20.0676	19.7667	19.5728	19.3696	19.1579
alpha	2.2626	2.2772	2.2772	2.3049	2.3219	2.3301	2.3378	2.3378	2.3178	2.3049	2.2913	2.2772
(86)m	0.9781	0.9608	0.9291	0.8730	0.7741	0.6406	0.4851	0.5181	0.7539	0.9061	0.9678	0.9805 (86)
(87)m	17.8808	18.2410	18.8390	19.4869	20.1776	20.6397	20.8760	20.8570	20.4423	19.5982	18.5321	17.9433 (87)
(88)m	19.7161	19.7288	19.7288	19.7520	19.7659	19.7725	19.7787	19.7787	19.7626	19.7520	19.7407	19.7288 (88)
(89)m	0.9742	0.9541	0.9162	0.8494	0.7284	0.5608	0.3644	0.3931	0.6848	0.8827	0.9612	0.9770 (89)
(90)m	16.8970	17.2611	17.8498	18.4921	19.1500	19.5558	19.7317	19.7233	19.3999	18.6148	17.5611	16.9677 (90)
Living area fraction	f _{LA} = Living area / (4) =											0.4108 (91)
(92)m	17.3012	17.6637	18.2562	18.9008	19.5722	20.0011	20.2018	20.1891	19.8282	19.0188	17.9600	17.3685 (92)
Temperature adjustment												0.0000
(93)m	17.3012	17.6637	18.2562	18.9008	19.5722	20.0011	20.2018	20.1891	19.8282	19.0188	17.9600	17.3685 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m	0.9637	0.9389	0.8967	0.8297	0.7202	0.5771	0.4090	0.4383	0.6890	0.8652	0.9481	0.9674 (94)
(95)m	716.2249	905.3992	1051.9246	1173.4771	1124.6876	912.5102	625.4375	612.9290	828.4704	848.2135	723.6389	662.2562 (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	2828.0488	2765.6108	2501.9095	2180.5263	1661.0081	1132.6756	688.3931	685.7384	1170.1083	1756.8626	2367.3996	2722.9938 (97)
(98)m	1571.1970	1250.0622	1078.7888	725.0754	399.0225	0.0000	0.0000	0.0000	0.0000	676.0349	1183.5077	1533.1888 (98)
Space heating (October to May) (kWh/year)												8416.8773 (98)
Space heating requirement in kWh/m2/year												(98) / (4) = 55.8815 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	0.0000	0.0000	0.0000	0.0000	0.0000	15.2000	17.4000	17.6000	0.0000	0.0000	0.0000	0.0000
(100)m	0.0000	0.0000	0.0000	0.0000	0.0000	1845.4553	1376.0301	1334.3323	0.0000	0.0000	0.0000	0.0000 (100)
(101)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.7379	0.8127	0.8067	0.0000	0.0000	0.0000	0.0000 (101)
(102)m	0.0000	0.0000	0.0000	0.0000	0.0000	1361.7987	1118.3538	1076.3412	0.0000	0.0000	0.0000	0.0000 (102)
(103)m	0.0000	0.0000	0.0000	0.0000	0.0000	2064.7710	1965.6568	1864.6145	0.0000	0.0000	0.0000	0.0000 (103)
(104)m	0.0000	0.0000	0.0000	0.0000	0.0000	506.1400	630.3935	586.4754	0.0000	0.0000	0.0000	0.0000 (104)
(98)m	0.0000	0.0000	0.0000	0.0000	0.0000	82.7392	19.1237	17.1469	0.0000	0.0000	0.0000	0.0000 (98)
(104)m	0.0000	0.0000	0.0000	0.0000	0.0000	506.1400	630.3935	586.4754	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	f _C = cooled area / (4) =											1.0000 (105)
(106)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
(107)m	0.0000	0.0000	0.0000	0.0000	0.0000	126.5350	157.5984	146.6188	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement in kWh/m2/year	Total = Sum(107)6..8 =											430.7522 (107)
	(107) / (4) =											2.8599 (108)

8f. Fabric Energy Efficiency

Fabric Energy Efficiency	(99) + (108) =	58.7414
Fabric Energy Efficiency rounded		58.7 (109)

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 Design SAP 2009 version 4.03r03

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	76.5200 (1b)	x	2.3300 (2b) =
First floor	74.1000 (1c)	x	2.0600 (2c) =
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.6200		178.2916 (1b) - (3b) 152.6460 (1c) - (3c) (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	330.9376 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1511 (8)
Pressure test					Yes
Measured/design q50					9.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.6011 (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) =	0.5109 (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	0.6897	0.6514	0.6514	0.5748	0.5237	0.4981	0.4726	0.4726	0.5365	0.5748	0.6131	0.6514 (22b)
Effective ach	0.7379	0.7122	0.7122	0.6652	0.6371	0.6241	0.6117	0.6117	0.6439	0.6652	0.6880	0.7122 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Doors			3.7900	1.8000	6.8220		(26)
Windows (Uw = 1.60)			24.7900	1.5038	37.2782		(27)
Rooflights (Uw = 1.60)			4.8000	1.5038	7.2180		(27a)
Ground Floor			76.5200	0.2100	16.0692		(28a)
Over Boathouse			18.4600	0.2200	4.0612		(28b)
External Wall	104.4800	26.6700	77.8100	0.2900	22.5649		(29a)
Semi Exposed Garage	14.0500	1.9100	12.1400	0.2628	3.1905		(29a)
Perimeter Stud	32.0200		32.0200	0.2833	9.0700		(29a)
External Roof	55.2200		55.2200	0.1500	8.2830		(30)
Skilling Roof	58.9400	4.8000	54.1400	0.1500	8.1210		(30)
Total net area of external elements Aum(A, m ²)			359.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		122.6781		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.2058 (36)
Total fabric heat loss						(33) + (36) =	142.8839 (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	80.5829	77.7766	77.7766	72.6451	69.5805	68.1550	66.8009	66.8009	70.3199	72.6451	75.1307	77.7766 (38)
(39)m	223.4668	220.6605	220.6605	215.5290	212.4644	211.0390	209.6848	209.6848	213.2038	215.5290	218.0146	220.6605 (39)
(40)m	1.4836	1.4650	1.4650	1.4309	1.4106	1.4011	1.3921	1.3921	Average = Sum(39)m / 12 =	1.4155	1.4309	1.4474
(41)m	31	28	31	30	31	30	31	31	Average = Sum(40)m / 12 =	30	31	30

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												2.9352 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												103.9099 (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	114.3008	110.1444	105.9881	101.8317	97.6753	93.5189	93.5189	97.6753	101.8317	105.9881	110.1444	114.3008 (44)
(45)m	169.9104	148.6047	153.3467	133.6914	128.2801	110.6959	102.5761	117.7075	119.1133	138.8151	151.5275	164.5491 (45)
Energy content (annual)										Total = Sum(45)m =		1638.8179 (45)
(46)m	25.4866	22.2907	23.0020	20.0537	19.2420	16.6044	15.3864	17.6561	17.8670	20.8223	22.7291	24.6824 (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	49.7742	46.1189	47.6562	49.7742	49.3151	50.9589	49.3151	50.9589 (61)
(62)m	220.8693	194.6321	204.3056	183.0065	178.0543	156.8148	150.2323	167.4818	168.4284	189.7740	200.8426	215.5080 (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.	220.8693	194.6321	204.3056	183.0065	178.0543	156.8148	150.2323	Solar Input (sum of months) = Sum(63)m =	167.4818	168.4284	189.7740	200.8426
RHI water heating demand								Total per year (kWh/year) = Sum(64)m =	167.4818	168.4284	189.7740	200.8426
(65)m	69.2349	60.9179	63.7275	56.7812	55.0967	48.3361	46.0206	51.5813	51.9340	58.8958	62.7117	67.4523 (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	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091 (66)

(67)m	89.9817	79.9210	64.9961	49.2062	36.7822	31.0531	33.5540	43.6147	58.5396	74.3295	86.7535	92.4826 (67)
(68)m	479.3973	484.3720	471.8360	445.1485	411.4603	379.7981	358.6458	353.6711	366.2071	392.8946	426.5829	458.2450 (68)
(69)m	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461 (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	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061 (71)
(72)m	93.0577	90.6516	85.6553	78.8627	74.0547	67.1335	61.8556	69.3297	72.1305	79.1610	87.0996	90.6617 (72)
(73)m	776.6858	769.1937	736.7365	687.4665	636.5463	592.2338	568.3945	580.8647	611.1263	660.6342	714.6850	755.6384 (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	6.0200	14.5154	0.6300	0.7000	0.7700	26.7052 (75)
Southeast	13.6700	44.4919	0.6300	0.7000	0.7700	185.8750 (77)
Southwest	4.1500	44.4919	0.6300	0.7000	0.7700	56.4288 (79)
Northwest	0.9500	14.5154	0.6300	0.7000	0.7700	4.2143 (81)
Horizontal	4.8000	33.0000	0.6300	0.7000	1.0000	62.8690 (82)

(83)m	336.0922	522.2569	779.4776	1045.9784	1260.1649	1356.5522	1287.7234	1188.6194	919.3960	636.1196	420.1139	276.1432 (83)
(84)m	1112.7780	1291.4506	1516.2141	1733.4449	1896.7112	1948.7860	1856.0279	1769.4841	1530.5223	1296.7537	1134.7989	1031.7816 (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	18.7226	18.9608	18.9608	19.4122	19.6922	19.8252	19.9532	19.9532	19.6239	19.4122	19.1909	18.9608
(86)m	0.9458	0.9267	0.8804	0.8157	0.6766	0.5272	0.3755	0.3725	0.6269	0.8266	0.9206	0.9503 (86)
(87)m	18.4363	18.6694	19.2418	19.7794	20.4546	20.7855	20.9366	20.9411	20.6759	20.0153	19.0991	18.4853 (87)
(88)m	19.7035	19.7174	19.7174	19.7431	19.7585	19.7657	19.7726	19.7726	19.7548	19.7431	19.7306	19.7174 (88)
(89)m	0.9363	0.9144	0.8597	0.7840	0.6181	0.4405	0.2588	0.2493	0.5383	0.7861	0.9048	0.9414 (89)
(90)m	16.3856	16.7238	17.5374	18.2974	19.2032	19.5978	19.7451	19.7494	19.4866	18.6468	17.3549	16.4646 (90)
Living area fraction												fLA = Living area / (4) =
(92)m	17.2281	17.5231	18.2376	18.9062	19.7173	20.0858	20.2346	20.2390	19.9752	19.2090	18.0715	17.2948 (92)
Temperature adjustment												-0.1500
(93)m	17.0781	17.3731	18.0876	18.7562	19.5673	19.9358	20.0846	20.0890	19.8252	19.0590	17.9215	17.1448 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m	0.9086	0.8833	0.8256	0.7539	0.6080	0.4534	0.2899	0.2826	0.5439	0.7587	0.8737	0.9150 (94)
(95)m	1011.0693	1140.7191	1251.7453	1306.8788	1153.2310	883.5161	538.1260	500.1419	832.4239	983.9012	991.4695	944.1163 (95)
(96)m	5.5000	5.7000	7.5000	9.2000	12.6000	15.2000	17.4000	17.6000	15.1000	11.8000	8.1000	5.9000 (96)
(97)m	2587.3202	2575.7925	2336.2642	2059.6491	1480.3025	999.4292	562.9217	521.9046	1007.4315	1564.5244	2141.2237	2481.2871 (97)
(98)m	1172.7307	964.3693	806.8821	541.9946	243.3412	0.0000	0.0000	0.0000	0.0000	431.9837	827.8230	1143.6551 (98)
Space heating (October to May) (kwh/year)												6132.7797 (98)
RHI space heating demand												6133 (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 Design SAP 2009 version 4.03r03

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	76.5200 (1b)	x 2.3300 (2b)	= 178.2916 (1b) - (3b)
First floor	74.1000 (1c)	x 2.0600 (2c)	= 152.6460 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	330.9376 (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					5 * 10 = 50.0000 (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 50.0000 / (5) = 0.1511 (8)
Pressure test					Yes
Measured/design q50					9.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.6011 (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) =	0.5109 (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	0.6897	0.6514	0.6514	0.5748	0.5237	0.4981	0.4726	0.4726	0.5365	0.5748	0.6131	0.6514 (22b)
Effective ach	0.7379	0.7122	0.7122	0.6652	0.6371	0.6241	0.6117	0.6117	0.6439	0.6652	0.6880	0.7122 (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			3.7900	1.8000	6.8220		(26)					
Windows (Uw = 1.60)			24.7900	1.5038	37.2782		(27)					
Rooflights (Uw = 1.60)			4.8000	1.5038	7.2180		(27a)					
Ground Floor			76.5200	0.2100	16.0692		(28a)					
Over Boathouse			18.4600	0.2200	4.0612		(28b)					
External Wall	104.4800	26.6700	77.8100	0.2900	22.5649		(29a)					
Semi Exposed Garage	14.0500	1.9100	12.1400	0.2628	3.1905		(29a)					
Perimeter Stud	32.0200		32.0200	0.2833	9.0700		(29a)					
External Roof	55.2200		55.2200	0.1500	8.2830		(30)					
Skilling Roof	58.9400	4.8000	54.1400	0.1500	8.1210		(30)					
Total net area of external elements Aum(A, m2)			359.6900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		122.6781		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.2058 (36)					
Total fabric heat loss						(33) + (36) =	142.8839 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	80.5829	77.7766	77.7766	72.6451	69.5805	68.1550	66.8009	66.8009	70.3199	72.6451	75.1307	77.7766 (38)
(39)m	223.4668	220.6605	220.6605	215.5290	212.4644	211.0390	209.6848	209.6848	213.2038	215.5290	218.0146	220.6605 (39)
(40)m	1.4836	1.4650	1.4650	1.4309	1.4106	1.4011	1.3921	1.3921	Average = Sum(39)m / 12 = 1.4155	1.4309	1.4474	215.8831 (39)
(41)m	31	28	31	30	31	30	31	31	Average = Sum(40)m / 12 = 1.4155	1.4309	1.4474	1.4650 (40)
												1.4333 (40)
												31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												2.9352 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												103.9099 (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	114.3008	110.1444	105.9881	101.8317	97.6753	93.5189	93.5189	97.6753	101.8317	105.9881	110.1444	114.3008 (44)
(45)m	169.9104	148.6047	153.3467	133.6914	128.2801	110.6959	102.5761	117.7075	119.1133	138.8151	151.5275	164.5491 (45)
Energy content (annual)										Total = Sum(45)m =		1638.8179 (45)
(46)m	25.4866	22.2907	23.0020	20.0537	19.2420	16.6044	15.3864	17.6561	17.8670	20.8223	22.7291	24.6824 (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	49.7742	46.1189	47.6562	49.7742	49.3151	50.9589	49.3151	50.9589 (61)
(62)m	220.8693	194.6321	204.3056	183.0065	178.0543	156.8148	150.2323	167.4818	168.4284	189.7740	200.8426	215.5080 (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.	220.8693	194.6321	204.3056	183.0065	178.0543	156.8148	150.2323	167.4818	168.4284	189.7740	200.8426	215.5080 (64)
(65)m	69.2349	60.9179	63.7275	56.7812	55.0967	48.3361	46.0206	51.5813	51.9340	58.8958	62.7117	67.4523 (65)
										Total per year (kWh/year) = Sum(64)m =		2229.9497 (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	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091 (66)
(67)m	89.9817	79.9210	64.9961	49.2062	36.7822	31.0531	33.5540	43.6147	58.5396	74.3295	86.7535	92.4826 (67)

(68)m	479.3973	484.3720	471.8360	445.1485	411.4603	379.7981	358.6458	353.6711	366.2071	392.8946	426.5829	458.2450	(68)
(69)m	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	(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	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	(71)
(72)m	93.0577	90.6516	85.6553	78.8627	74.0547	67.1335	61.8556	69.3297	72.1305	79.1610	87.0996	90.6617	(72)
(73)m	776.6858	769.1937	736.7365	687.4665	636.5463	592.2338	568.3045	580.8647	611.1263	660.6342	714.6850	755.6384	(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	6.0200	11.5098	0.6300	0.7000	0.7700	21.1755 (75)
Southeast	13.6700	37.3877	0.6300	0.7000	0.7700	156.1956 (77)
Southwest	4.1500	37.3877	0.6300	0.7000	0.7700	47.4186 (79)
Northwest	0.9500	11.5098	0.6300	0.7000	0.7700	3.3417 (81)
Horizontal	4.8000	26.0000	0.6300	0.7000	1.0000	49.5331 (82)

(83)m	277.6645	500.1541	725.3281	993.7888	1170.4194	1217.1520	1181.9123	1046.7765	836.0719	586.6868	337.9294	233.9459	(83)
(84)m	1054.3503	1269.3478	1462.0646	1681.2553	1806.9657	1809.3858	1750.2168	1627.6412	1447.1982	1247.3210	1052.6144	989.5843	(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	18.7226	18.9608	18.9608	19.4122	19.6922	19.8252	19.9532	19.9532	19.6239	19.4122	19.1909	18.9608	
alpha	2.2482	2.2641	2.2641	2.2941	2.3128	2.3217	2.3302	2.3302	2.3083	2.2941	2.2794	2.2641	
(86)m	0.9565	0.9345	0.8964	0.8344	0.7287	0.5920	0.4386	0.4642	0.6932	0.8606	0.9403	0.9594	(86)
(87)m	18.1519	18.4929	19.0507	19.6508	20.2828	20.6950	20.8992	20.8861	20.5380	19.7840	18.7822	18.2161	(87)
(88)m	19.7035	19.7174	19.7174	19.7431	19.7585	19.7657	19.7726	19.7726	19.7548	19.7431	19.7306	19.7174	(88)
(89)m	0.9492	0.9238	0.8789	0.8060	0.6791	0.5118	0.3248	0.3462	0.6186	0.8293	0.9289	0.9524	(89)
(90)m	15.9738	16.4690	17.2666	18.1206	18.9857	19.5034	19.7183	19.7103	19.3288	18.3293	16.9002	16.0741	(90)
Living area fraction									fLA = Living area / (4) =				
(92)m	16.8686	17.3005	17.9996	18.7492	19.5186	19.9929	20.2035	20.1934	19.8256	18.9270	17.6734	16.9541	(92)
Temperature adjustment												-0.1500	
(93)m	16.7186	17.1505	17.8496	18.5992	19.3686	19.8429	20.0535	20.0434	19.6756	18.7770	17.5234	16.8041	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m	0.9243	0.8939	0.8450	0.7743	0.6613	0.5173	0.3525	0.3741	0.6131	0.7985	0.9006	0.9287	(94)
(95)m	974.5140	1134.6413	1235.4942	1301.8212	1194.9010	935.9609	616.9207	608.9285	887.2962	996.0163	948.0313	919.0230	(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	2730.4572	2681.1288	2438.2076	2133.5695	1629.3119	1106.4662	661.2347	659.1198	1146.0917	1719.2645	2294.2570	2626.7705	(97)
(98)m	1306.4217	1039.2396	894.8188	598.8588	323.2017	0.0000	0.0000	0.0000	0.0000	538.0966	969.2825	1270.5641	(98)
Space heating (October to May) (kWh/year)												6940.4838	(98)
Space heating requirement in kWh/m2/year											(98) / (4) =	46.0794	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.9000	(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	1306.4217	1039.2396	894.8188	598.8588	323.2017	0.0000	0.0000	0.0000	0.0000	538.0966	969.2825	1270.5641	(98)
(211)m	1437.2076	1143.2779	984.3991	658.8105	355.5574	0.0000	0.0000	0.0000	0.0000	591.9655	1066.3174	1397.7603	(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												7635.2957	(215)
Space heating fuel used, secondary												0.0000	(211)
Water heating													
(64)m	220.8693	194.6321	204.3056	183.0065	178.0543	156.8148	150.2323	167.4818	168.4284	189.7740	200.8426	215.5080	(64)
Efficiency of water heater												80.8000	(216)
(217)m	89.2860	89.1423	88.8359	88.3160	87.0354	80.8000	80.8000	80.8000	80.8000	88.0310	88.9907	89.2816	(217)
(219)m	247.3728	218.3386	229.9809	207.2177	204.5768	194.0778	185.9310	207.2794	208.4510	215.5763	225.6895	241.3802	(219)
Water heating fuel used												2585.8720	(219)
Electricity for pumps, fans and electric keep-hot (Table 4f):													
boiler with a fan-assisted flue												45.0000	(230e)
Total electricity for the above, kWh/year												45.0000	(231)
Electricity for lighting (calculated in Appendix L)												635.6422	(232)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	7635.2957	3.1000	236.6942 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating cost (other fuel)	2585.8720	3.1000	80.1620 (247)
Pumps and fans for heating	45.0000	11.4600	5.1570 (249)
Energy for lighting	635.6422	11.4600	72.8446 (250)
Additional standing charges			106.0000 (251)
Total energy cost			500.8578 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4700 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2034 (257)
SAP value		83.2130
SAP rating (Section 12)		83 (258)
SAP band		B

10a. Fuel costs - using BEDF prices (382)

	Fuel kwh/year	Fuel price p/kwh	Fuel cost £/year
Space heating - main system 1	7635.2957	4.2500	324.5001 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating cost (other fuel)	2585.8720	4.2500	109.8996 (247)
Pumps and fans for heating	45.0000	15.0600	6.7770 (249)
Energy for lighting	635.6422	15.0600	95.7277 (250)
Additional standing charges			101.0000 (251)
Total energy cost			637.9043 (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	7635.2957	0.1980	1511.7885 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	2585.8720	0.1980	512.0027 (264)
Space and water heating			2023.7912 (265)
Pumps and fans	45.0000	0.5170	23.2650 (267)
Energy for lighting	635.6422	0.5170	328.6270 (268)
Total CO2, kg/year			2375.6832 (272)
CO2 emissions per m2			15.7700 (273)
EI value			83.7265
EI rating			84 (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	7635.2957	1.0200	7788.0016 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	2585.8720	1.0200	2637.5894 (264)
Space and water heating			10425.5910 (265)
Pumps and fans	45.0000	2.9200	131.4000 (267)
Energy for lighting	635.6422	2.9200	1856.0751 (268)
Primary energy kwh/year			12413.0661 (272)
Primary energy kwh/m2/year			82.4131 (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 Design SAP 2009 version 4.03r03

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	76.5200 (1b)	x 2.3300 (2b)	= 178.2916 (1b) - (3b)
First floor	74.1000 (1c)	x 2.0600 (2c)	= 152.6460 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	330.9376 (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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1511 (8)
Pressure test					Yes
Measured/design q50					9.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.6011 (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) =	0.5109 (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	0.6897	0.6514	0.6514	0.5748	0.5237	0.4981	0.4726	0.4726	0.5365	0.5748	0.6131	0.6514 (22b)
Effective ach	0.7379	0.7122	0.7122	0.6652	0.6371	0.6241	0.6117	0.6117	0.6439	0.6652	0.6880	0.7122 (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			3.7900	1.8000	6.8220		(26)					
Windows (Uw = 1.60)			24.7900	1.5038	37.2782		(27)					
Rooflights (Uw = 1.60)			4.8000	1.5038	7.2180		(27a)					
Ground Floor			76.5200	0.2100	16.0692		(28a)					
Over Boathouse			18.4600	0.2200	4.0612		(28b)					
External Wall	104.4800	26.6700	77.8100	0.2900	22.5649		(29a)					
Semi Exposed Garage	14.0500	1.9100	12.1400	0.2628	3.1905		(29a)					
Perimeter Stud	32.0200		32.0200	0.2833	9.0700		(29a)					
External Roof	55.2200		55.2200	0.1500	8.2830		(30)					
Skilling Roof	58.9400	4.8000	54.1400	0.1500	8.1210		(30)					
Total net area of external elements Aum(A, m2)			359.6900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		122.6781		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.2058 (36)					
Total fabric heat loss						(33) + (36) =	142.8839 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	80.5829	77.7766	77.7766	72.6451	69.5805	68.1550	66.8009	66.8009	70.3199	72.6451	75.1307	77.7766 (38)
(39)m	223.4668	220.6605	220.6605	215.5290	212.4644	211.0390	209.6848	209.6848	213.2038	215.5290	218.0146	220.6605 (39)
(40)m	1.4836	1.4650	1.4650	1.4309	1.4106	1.4011	1.3921	1.3921	Average = Sum(39)m / 12 = 1.4155	1.4309	1.4474	215.8831 (39)
(41)m	31	28	31	30	31	30	31	31	Average = Sum(40)m / 12 = 1.4155	1.4309	1.4474	1.4650 (40)
												1.4333 (40)
												31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												2.9352 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												103.9099 (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	114.3008	110.1444	105.9881	101.8317	97.6753	93.5189	93.5189	97.6753	101.8317	105.9881	110.1444	114.3008 (44)
(45)m	169.9104	148.6047	153.3467	133.6914	128.2801	110.6959	102.5761	117.7075	119.1133	138.8151	151.5275	164.5491 (45)
Energy content (annual)										Total = Sum(45)m =		1638.8179 (45)
(46)m	25.4866	22.2907	23.0020	20.0537	19.2420	16.6044	15.3864	17.6561	17.8670	20.8223	22.7291	24.6824 (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	49.7742	46.1189	47.6562	49.7742	49.3151	50.9589	49.3151	50.9589 (61)
(62)m	220.8693	194.6321	204.3056	183.0065	178.0543	156.8148	150.2323	167.4818	168.4284	189.7740	200.8426	215.5080 (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.	220.8693	194.6321	204.3056	183.0065	178.0543	156.8148	150.2323	167.4818	168.4284	189.7740	200.8426	215.5080 (64)
(65)m	69.2349	60.9179	63.7275	56.7812	55.0967	48.3361	46.0206	51.5813	51.9340	58.8958	62.7117	67.4523 (65)
Solar Input (sum of months) = Sum(63)m =												0.0000 (63)
Total per year (kWh/year) = Sum(64)m =												2229.9497 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576 (66)
(67)m	35.9927	31.9684	25.9984	19.6825	14.7129	12.4212	13.4216	17.4459	23.4158	29.7318	34.7014	36.9930 (67)

(68)m	321.1962	324.5292	316.1301	298.2495	275.6784	254.4647	240.2927	236.9597	245.3588	263.2394	285.8105	307.0242	(68)
(69)m	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	(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	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	(71)
(72)m	93.0577	90.6516	85.6553	78.8627	74.0547	67.1335	61.8556	69.3297	72.1305	79.1610	87.0996	90.6617	(72)
(73)m	517.2739	514.1765	494.8111	463.8220	431.4732	401.0467	382.5972	390.7626	407.9324	439.1594	474.6387	501.7062	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
Northeast	6.0200	11.5098	0.6300	0.7000	0.7700	21.1755 (75)
Southeast	13.6700	37.3877	0.6300	0.7000	0.7700	156.1956 (77)
Southwest	4.1500	37.3877	0.6300	0.7000	0.7700	47.4186 (79)
Northwest	0.9500	11.5098	0.6300	0.7000	0.7700	3.3417 (81)
Horizontal	4.8000	26.0000	0.6300	0.7000	1.0000	49.5331 (82)

(83)m	277.6645	500.1541	725.3281	993.7888	1170.4194	1217.1520	1181.9123	1046.7765	836.0719	586.6868	337.9294	233.9459	(83)
(84)m	794.9383	1014.3307	1220.1392	1457.6107	1601.8927	1618.1987	1564.5095	1437.5391	1244.0042	1025.8462	812.5681	735.6521	(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	18.7226	18.9608	18.9608	19.4122	19.6922	19.8252	19.9532	19.6239	19.4122	19.1909	18.9608	
alpha	2.2482	2.2641	2.2641	2.2941	2.3128	2.3217	2.3302	2.3083	2.2941	2.2794	2.2641	
(86)m	0.9749	0.9569	0.9243	0.8674	0.7675	0.6337	0.4785	0.5095	0.7443	0.8990	0.9636	0.9774 (86)
(87)m	17.9036	18.2624	18.8552	19.5011	20.1878	20.6451	20.8784	20.8607	20.4542	19.6205	18.5599	17.9697 (87)
(88)m	19.7035	19.7174	19.7174	19.7431	19.7585	19.7657	19.7726	19.7726	19.7548	19.7431	19.7306	19.7174 (88)
(89)m	0.9705	0.9495	0.9106	0.8429	0.7210	0.5534	0.3583	0.3851	0.6739	0.8742	0.9562	0.9733 (89)
(90)m	15.6170	16.1410	16.9944	17.9204	18.8708	19.4547	19.7056	19.6944	19.2384	18.1115	16.5840	15.7195 (90)
Living area fraction	fLA = Living area / (4) =											0.4108 (91)
(92)m	16.5564	17.0125	17.7589	18.5698	19.4119	19.9438	20.1874	20.1736	19.7379	18.7315	17.3957	16.6440 (92)
Temperature adjustment												-0.1500
(93)m	16.4064	16.8625	17.6089	18.4198	19.2619	19.7938	20.0374	20.0236	19.5879	18.5815	17.2457	16.4940 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m	0.9527	0.9250	0.8794	0.8101	0.6992	0.5555	0.3862	0.4128	0.6627	0.8432	0.9341	0.9569 (94)
(95)m	757.3260	938.2530	1072.9684	1180.8815	1119.9984	898.8748	604.2371	593.3771	824.4225	865.0167	759.0517	703.9254 (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	2660.6918	2617.5875	2385.0994	2094.9019	1606.6305	1096.0941	657.8716	654.9629	1127.3908	1677.1363	2233.7222	2558.3358 (97)
(98)m	1416.1042	1128.5128	976.2255	658.0947	362.0543	0.0000	0.0000	0.0000	0.0000	604.2169	1061.7628	1379.6813 (98)
Space heating (October to May) (kWh/year)												7586.6524 (98)
Space heating requirement in kWh/m ² /year												(98) / (4) = 50.3695 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	90.9000 (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	1416.1042	1128.5128	976.2255	658.0947	362.0543	0.0000	0.0000	0.0000	0.0000	604.2169	1061.7628	1379.6813	(98)
(211)m	1557.8704	1241.4882	1073.9554	723.9766	398.2995	0.0000	0.0000	0.0000	0.0000	664.7051	1168.0558	1517.8012	(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													8346.1522 (211)
Space heating fuel used, secondary													0.0000 (215)

Water heating													
(64)m	220.8693	194.6321	204.3056	183.0065	178.0543	156.8148	150.2323	167.4818	168.4284	189.7740	200.8426	215.5080 (64)	
Efficiency of water heater												80.8000 (216)	
(217)m	89.3923	89.2588	88.9752	88.4932	87.3024	80.8000	80.8000	80.8000	80.8000	88.2630	89.1278	89.3904 (217)	
(219)m	247.0785	218.0537	229.6208	206.8028	203.9511	194.0778	185.9310	207.2794	208.4510	215.0097	225.3423	241.0862 (219)	

Water heating fuel used 2582.6844 (219)

Electricity for pumps, fans and electric keep-hot (Table 4f):	
boiler with a fan-assisted flue	45.0000 (230e)
Total electricity for the above, kWh/year	45.0000 (231)
Electricity for lighting (calculated in Appendix L)	635.6422 (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	8346.1522	0.1980	1652.5381 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	2582.6844	0.1980	511.3715 (264)
Space and water heating			2163.9096 (265)
Pumps and fans	45.0000	0.5170	23.2650 (267)
Energy for lighting	635.6422	0.5170	328.6270 (268)
Total CO2, kg/year			2515.8016 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.7000 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES			
DER		16.7000	ZC1
Total Floor Area	TFA	150.6200	
Assumed number of occupants	N	2.9352	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5200	
CO2 emissions from appliances, equation (L14)		12.8802	ZC2
CO2 emissions from cooking, equation (L16)		1.2578	ZC3
Total CO2 emissions		30.8379	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.8379	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 Design SAP 2009 version 4.03r03

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	76.5200 (1b)	x 2.3300 (2b)	= 178.2916 (1b) - (3b)
First floor	74.1000 (1c)	x 2.0000 (2c)	= 152.6400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	330.9376 (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) = 0.0907 (8)
Pressure test					Yes
Measured/design q50					10.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.5907 (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) =	0.5021 (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	0.6778	0.6401	0.6401	0.5648	0.5146	0.4895	0.4644	0.4644	0.5272	0.5648	0.6025	0.6401 (22b)
Effective ach	0.7297	0.7049	0.7049	0.6595	0.6324	0.6198	0.6078	0.6078	0.6389	0.6595	0.6815	0.7049 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Doors			1.8500	2.0000	3.7000		(26)
Windows (Uw = 2.00)			35.8050	1.8519	66.3056		(27)
Ground Floor			76.5200	0.2500	19.1300		(28a)
Over Boathouse			18.4600	0.2500	4.6150		(28b)
External Wall	150.5500	37.6550	112.8950	0.3500	39.5133		(29a)
External Roof	114.1600		114.1600	0.1600	18.2656		(30)
Total net area of external elements Aum(A, m ²)			359.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		151.5294		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.110 * total exposed area)							39.5659 (36)
Total fabric heat loss						(33) + (36) =	191.0953 (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	79.6888	76.9791	76.9791	72.0242	69.0650	67.6887	66.3811	66.3811	69.7790	72.0242	74.4242	76.9791 (38)
(39)m	270.7841	268.0744	268.0744	263.1195	260.1603	258.7840	257.4765	257.4765	260.8743	263.1195	265.5195	268.0744 (39)
(40)m	1.7978	1.7798	1.7798	1.7469	1.7273	1.7181	1.7094	1.7094	Average = Sum(39)m / 12 =	1.7320	1.7469	1.7628
(41)m	31	28	31	30	31	30	31	31	Average = Sum(40)m / 12 =	30	31	30

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												2.9352 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												109.3788 (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	120.3167	115.9415	111.5664	107.1912	102.8161	98.4409	98.4409	102.8161	107.1912	111.5664	115.9415	120.3167 (44)
(45)m	178.8530	156.4260	161.4176	140.7278	135.0317	116.5220	107.9748	123.9027	125.3825	146.1212	159.5027	173.2096 (45)
Energy content (annual)										Total = Sum(45)m =		1725.0714 (45)
(46)m	26.8280	23.4639	24.2126	21.1092	20.2547	17.4783	16.1962	18.5854	18.8074	21.9182	23.9254	25.9814 (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	275.1894	243.4395	257.7540	233.9566	231.3681	209.7508	204.3112	220.2391	218.6112	242.4576	252.7315	269.5460 (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.	275.1894	243.4395	257.7540	233.9566	231.3681	209.7508	204.3112	Solar input (sum of months) = Sum(63)m =		220.2391	218.6112	242.4576
(65)m	136.5378	121.6225	130.7405	121.3750	121.9672	113.3266	112.9708	Total per year (kWh/year) = Sum(64)m =		2859.3550 (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	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	146.7576	(66)
(67)m	48.6793	43.2365	35.1623	26.6201	19.8988	16.7994	18.1524	23.5952	31.6694	40.2116	46.9328	50.0322	(67)
(68)m	321.1962	324.5292	316.1301	298.2495	275.6784	254.4647	240.2927	236.9597	245.3588	263.2394	285.8105	307.0242	(68)
(69)m	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	37.6758	(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	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	(71)
(72)m	183.5185	180.9858	175.7265	168.5764	163.9343	157.3981	151.8424	158.9607	161.4899	168.8903	177.2468	180.9964	(72)
(73)m	630.4212	625.7788	604.0461	570.4733	536.5388	505.6895	487.3148	496.5428	515.5453	549.3686	587.0174	615.0801	(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
East					35.8050	19.8726			0.7200			0.7000		0.7700	248.5200 (76)
(83)m	248.5200	481.7024	769.9155	1143.1419	1390.8782	1451.3105	1408.6613	1225.9888	920.4655	586.6230	308.9749	205.0045	(83)		
(84)m	878.9413	1107.4812	1373.9617	1713.6151	1927.4171	1957.0000	1895.9761	1722.5316	1436.0107	1135.9916	895.9923	820.0846	(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	38.6275	39.0180	39.0180	39.7527	40.2049	40.4187	40.6240	40.6240	40.0949	39.7527	39.3934	39.0180		
alpha	3.5752	3.6012	3.6012	3.6502	3.6803	3.6946	3.7083	3.7083	3.6730	3.6502	3.6262	3.6012		
(86)m	0.9976	0.9943	0.9836	0.9513	0.8655	0.7170	0.5267	0.5700	0.8557	0.9745	0.9956	0.9980	(86)	
(87)m	18.9972	19.2168	19.6266	20.0967	20.5761	20.8570	20.9678	20.9582	20.7074	20.1132	19.4153	19.0436	(87)	
(88)m	19.4769	19.4894	19.4894	19.5125	19.5263	19.5328	19.5389	19.5389	19.5230	19.5125	19.5013	19.4894	(88)	
(89)m	0.9967	0.9922	0.9769	0.9310	0.8074	0.5982	0.3532	0.3868	0.7649	0.9596	0.9937	0.9971	(89)	
(90)m	17.7037	17.9314	18.3374	18.8097	19.2555	19.4730	19.5334	19.5315	19.3741	18.8363	18.1388	17.7592	(90)	
Living area fraction										fLA = Living area / (4) =			0.4108	(91)
(92)m	18.2351	18.4595	18.8671	19.3384	19.7981	20.0416	20.1227	20.1176	19.9218	19.3609	18.6632	18.2868	(92)	
Temperature adjustment													0.0000	
(93)m	18.2351	18.4595	18.8671	19.3384	19.7981	20.0416	20.1227	20.1176	19.9218	19.3609	18.6632	18.2868	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m	0.9956	0.9901	0.9731	0.9280	0.8199	0.6435	0.4259	0.4639	0.7942	0.9575	0.9921	0.9962	(94)
(95)m	875.0719	1096.5219	1337.0511	1590.1949	1580.2078	1259.3932	807.5286	799.0356	1140.4907	1087.7109	888.8761	816.9726	(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	3719.2385	3608.1366	3234.8709	2799.1774	2106.7977	1408.2053	829.7680	828.4591	1466.5947	2252.5425	3096.8184	3588.6704	(97)
(98)m	2116.0599	1687.8051	1411.9779	870.4674	391.7828	0.0000	0.0000	0.0000	0.0000	866.6347	1589.7185	2062.1432	(98)
Space heating (October to May) (kWh/year)												10996.5896	(98)
Space heating requirement in kWh/m2/year												(98) / (4) =	73.0088 (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	2116.0599	1687.8051	1411.9779	870.4674	391.7828	0.0000	0.0000	0.0000	0.0000	866.6347	1589.7185	2062.1432	(98)	
(211)m	2413.7566	1925.2530	1610.6212	992.9286	446.9006	0.0000	0.0000	0.0000	0.0000	988.5567	1813.3671	2352.2546	(211)	
(215)m	211.6060	168.7805	141.1978	87.0467	39.1783	0.0000	0.0000	0.0000	0.0000	86.6635	158.9718	206.2143	(215)	
Annual totals kWh/year														
Space heating fuel used, main system 1													12543.6383	(211)
Space heating fuel used, secondary													1099.6590	(215)
Water heating														
(64)m	275.1894	243.4395	257.7540	233.9566	231.3681	209.7508	204.3112	220.2391	218.6112	242.4576	252.7315	269.5460	(64)	
Efficiency of water heater													68.8000	(216)
(217)m	77.4642	77.3319	76.9940	76.3234	74.5632	68.8000	68.8000	68.8000	68.8000	76.2457	77.1986	77.4580	(217)	
(219)m	355.2470	314.7981	334.7715	306.5331	310.2979	304.8704	296.9640	320.1149	317.7489	317.9951	327.3781	347.9900	(219)	
Water heating fuel used													3854.7091	(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)	859.6914	(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	12543.6383	0.1940	2433.4658	(261)
Space heating - secondary	1099.6590	0.4220	464.0561	(263)
Water heating cost (other fuel)	3854.7091	0.1940	747.8136	(264)
Space and water heating			3645.3355	(265)
Pumps and fans	175.0000	0.4220	73.8500	(267)
Energy for lighting	859.6914	0.4220	362.7898	(268)
Total CO2, kg/year			4081.9753	(272)
Emissions per m2 for space and water heating			24.6925	(272a)
Emissions per m2 for lighting			2.4086	(272b)

Target Carbon Dioxide Emission Rate (TER) 16.8900 (273)
= [(24.6925 * 1.00 * 1.0206) + (2.4086 * 1.2251)] * 0.60

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 Design SAP 2009 version 4.03r03

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	76.5200 (1b)	x 2.3300 (2b)	= 178.2916 (1b) - (3b)
First floor	74.1000 (1c)	x 2.0600 (2c)	= 152.6460 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	330.9376 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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 50.0000 / (5) = 0.1511 (8)
Pressure test					Yes
Measured/design q50					9.0000
If based on air permeability value, then (18) = [(17)/20]+(8), otherwise (18) = (16)					0.6011 (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) =	0.5109 (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	0.6897	0.6514	0.6514	0.5748	0.5237	0.4981	0.4726	0.4726	0.5365	0.5748	0.6131	0.6514 (22b)
Effective ach	0.7379	0.7122	0.7122	0.6652	0.6371	0.6241	0.6117	0.6117	0.6439	0.6652	0.6880	0.7122 (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			3.7900	1.8000	6.8220		(26)					
Windows (Uw = 1.60)			24.7900	1.5038	37.2782		(27)					
Rooflights (Uw = 1.60)			4.8000	1.5038	7.2180		(27a)					
Ground Floor			76.5200	0.2100	16.0692		(28a)					
Over Boathouse			18.4600	0.2200	4.0612		(28b)					
External Wall	104.4800	26.6700	77.8100	0.2900	22.5649		(29a)					
Semi Exposed Garage	14.0500	1.9100	12.1400	0.2628	3.1905		(29a)					
Perimeter Stud	32.0200		32.0200	0.2833	9.0700		(29a)					
External Roof	55.2200		55.2200	0.1500	8.2830		(30)					
Skilling Roof	58.9400	4.8000	54.1400	0.1500	8.1210		(30)					
Total net area of external elements Aum(A, m2)			359.6900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		122.6781		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.2058 (36)					
Total fabric heat loss						(33) + (36) =	142.8839 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	80.5829	77.7766	77.7766	72.6451	69.5805	68.1550	66.8009	66.8009	70.3199	72.6451	75.1307	77.7766 (38)
(39)m	223.4668	220.6605	220.6605	215.5290	212.4644	211.0390	209.6848	209.6848	213.2038	215.5290	218.0146	220.6605 (39)
(40)m	1.4836	1.4650	1.4650	1.4309	1.4106	1.4011	1.3921	1.3921	Average = Sum(39)m / 12 = 1.4155	1.4309	1.4474	215.8831 (39)
(41)m	31	28	31	30	31	30	31	31	Average = Sum(40)m / 12 = 1.4155	1.4309	1.4474	1.4650 (40)
												1.4333 (40)
												31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy, N												2.9352 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												103.9099 (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	114.3008	110.1444	105.9881	101.8317	97.6753	93.5189	93.5189	97.6753	101.8317	105.9881	110.1444	114.3008 (44)
(45)m	169.9104	148.6047	153.3467	133.6914	128.2801	110.6959	102.5761	117.7075	119.1133	138.8151	151.5275	164.5491 (45)
Energy content (annual)										Total = Sum(45)m =		1638.8179 (45)
(46)m	25.4866	22.2907	23.0020	20.0537	19.2420	16.6044	15.3864	17.6561	17.8670	20.8223	22.7291	24.6824 (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	49.7742	46.1189	47.6562	49.7742	49.3151	50.9589	49.3151	50.9589 (61)
(62)m	220.8693	194.6321	204.3056	183.0065	178.0543	156.8148	150.2323	167.4818	168.4284	189.7740	200.8426	215.5080 (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.	220.8693	194.6321	204.3056	183.0065	178.0543	156.8148	150.2323	167.4818	168.4284	189.7740	200.8426	215.5080 (64)
(65)m	69.2349	60.9179	63.7275	56.7812	55.0967	48.3361	46.0206	51.5813	51.9340	58.8958	62.7117	67.4523 (65)
										Total per year (kWh/year) = Sum(64)m =		2229.9497 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091	176.1091 (66)
(67)m	89.9817	79.9210	64.9961	49.2062	36.7822	31.0531	33.5540	43.6147	58.5396	74.3295	86.7535	92.4826 (67)

(68)m	479.3973	484.3720	471.8360	445.1485	411.4603	379.7981	358.6458	353.6711	366.2071	392.8946	426.5829	458.2450	(68)
(69)m	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	55.5461	(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	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	-117.4061	(71)
(72)m	93.0577	90.6516	85.6553	78.8627	74.0547	67.1335	61.8556	69.3297	72.1305	79.1610	87.0996	90.6617	(72)
(73)m	776.6858	769.1937	736.7365	687.4665	636.5463	592.2338	568.3045	580.8647	611.1263	660.6342	714.6850	755.6384	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
Northeast	6.0200	11.5098	0.6300	0.7000	0.7700	21.1755 (75)
Southeast	13.6700	37.3877	0.6300	0.7000	0.7700	156.1956 (77)
Southwest	4.1500	37.3877	0.6300	0.7000	0.7700	47.4186 (79)
Northwest	0.9500	11.5098	0.6300	0.7000	0.7700	3.3417 (81)
Horizontal	4.8000	26.0000	0.6300	0.7000	1.0000	49.5331 (82)

(83)m	277.6645	500.1541	725.3281	993.7888	1170.4194	1217.1520	1181.9123	1046.7765	836.0719	586.6868	337.9294	233.9459	(83)
(84)m	1054.3503	1269.3478	1462.0646	1681.2553	1806.9657	1809.3858	1750.2168	1627.6412	1447.1982	1247.3210	1052.6144	989.5843	(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	18.7226	18.9608	18.9608	19.4122	19.6922	19.8252	19.9532	19.9532	19.6239	19.4122	19.1909	18.9608
alpha	2.2482	2.2641	2.2641	2.2941	2.3128	2.3217	2.3302	2.3302	2.3083	2.2941	2.2794	2.2641
(86)m	0.9565	0.9345	0.8964	0.8344	0.7287	0.5920	0.4386	0.4642	0.6932	0.8606	0.9403	0.9594 (86)
(87)m	18.1519	18.4929	19.0507	19.6508	20.2828	20.6950	20.8992	20.8861	20.5380	19.7840	18.7822	18.2161 (87)
(88)m	19.7035	19.7174	19.7174	19.7431	19.7585	19.7657	19.7726	19.7726	19.7548	19.7431	19.7306	19.7174 (88)
(89)m	0.9492	0.9238	0.8789	0.8060	0.6791	0.5118	0.3248	0.3462	0.6186	0.8293	0.9289	0.9524 (89)
(90)m	15.9738	16.4690	17.2666	18.1206	18.9857	19.5034	19.7183	19.7103	19.3288	18.3293	16.9002	16.0741 (90)
Living area fraction	fLA = Living area / (4) =											
(92)m	16.8686	17.3005	17.9996	18.7492	19.5186	19.9929	20.2035	20.1934	19.8256	18.9270	17.6734	16.9541 (92)
Temperature adjustment	-0.1500											
(93)m	16.7186	17.1505	17.8496	18.5992	19.3686	19.8429	20.0535	20.0434	19.6756	18.7770	17.5234	16.8041 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m	0.9243	0.8939	0.8450	0.7743	0.6613	0.5173	0.3525	0.3741	0.6131	0.7985	0.9006	0.9287 (94)
(95)m	974.5140	1134.6413	1235.4942	1301.8212	1194.9010	935.9609	616.9207	608.9285	887.2962	996.0163	948.0313	919.0230 (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	2730.4572	2681.1288	2438.2076	2133.5695	1629.3119	1106.4662	661.2347	659.1198	1146.0917	1719.2645	2294.2570	2626.7705 (97)
(98)m	1306.4217	1039.2396	894.8188	598.8588	323.2017	0.0000	0.0000	0.0000	0.0000	538.0966	969.2825	1270.5641 (98)
Space heating (October to May) (kWh/year)												6940.4838 (98)
Space heating requirement in kWh/m2/year												(98) / (4) = 46.0794 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	90.9000 (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	1306.4217	1039.2396	894.8188	598.8588	323.2017	0.0000	0.0000	0.0000	0.0000	538.0966	969.2825	1270.5641 (98)
(211)m	1437.2076	1143.2779	984.3991	658.8105	355.5574	0.0000	0.0000	0.0000	0.0000	591.9655	1066.3174	1397.7603 (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												7635.2957 (211)
Space heating fuel used, secondary												0.0000 (215)

Water heating													
(64)m	220.8693	194.6321	204.3056	183.0065	178.0543	156.8148	150.2323	167.4818	168.4284	189.7740	200.8426	215.5080 (64)	
Efficiency of water heater												80.8000 (216)	
(217)m	89.2860	89.1423	88.8359	88.3160	87.0354	80.8000	80.8000	80.8000	80.8000	88.0310	88.9907	89.2816 (217)	
(219)m	247.3728	218.3386	229.9809	207.2177	204.5768	194.0778	185.9310	207.2794	208.4510	215.5763	225.6895	241.3802 (219)	

Water heating fuel used 2585.8720 (219)

Electricity for pumps, fans and electric keep-hot (Table 4f):	
boiler with a fan-assisted flue	45.0000 (230e)
Total electricity for the above, kWh/year	45.0000 (231)
Electricity for lighting (calculated in Appendix L)	635.6422 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 2.50 * 1073 * 0.80)	-1716.8000 (233)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	7635.2957	3.1000	236.6942 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating cost (other fuel)	2585.8720	3.1000	80.1620 (247)
Pumps and fans for heating	45.0000	11.4600	5.1570 (249)
Energy for lighting	635.6422	11.4600	72.8446 (250)
Additional standing charges			106.0000 (251)

Energy saving/generation technologies			
PV Unit	-1716.8000	11.4600	-196.7453 (252)
Total energy cost			304.1125 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4700 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7307 (257)
SAP value		89.8072
SAP rating (Section 12)		90 (258)
SAP band		B

10a. Fuel costs - using BEDF prices (382)

	Fuel kwh/year	Fuel price p/kwh	Fuel cost £/year
Space heating - main system 1	7635.2957	4.2500	324.5001 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating cost (other fuel)	2585.8720	4.2500	109.8996 (247)
Pumps and fans for heating	45.0000	15.0600	6.7770 (249)
Energy for lighting	635.6422	15.0600	95.7277 (250)
Additional standing charges			101.0000 (251)
Energy saving/generation technologies			
PV Unit	-1716.8000	15.0600	-258.5501 (252)
Total energy cost			379.3543 (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	7635.2957	0.1980	1511.7885 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	2585.8720	0.1980	512.0027 (264)
Space and water heating			2023.7912 (265)
Pumps and fans	45.0000	0.5170	23.2650 (267)
Energy for lighting	635.6422	0.5170	328.6270 (268)
Energy saving/generation technologies			
PV Unit	-1716.8000	0.5290	-908.1872 (269)
Total CO2, kg/year			1467.4960 (272)
CO2 emissions per m2			9.7400 (273)
EI value			89.9476
EI rating			90 (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	7635.2957	1.0200	7788.0016 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating cost (other fuel)	2585.8720	1.0200	2637.5894 (264)
Space and water heating			10425.5910 (265)
Pumps and fans	45.0000	2.9200	131.4000 (267)
Energy for lighting	635.6422	2.9200	1856.0751 (268)
Energy saving/generation technologies			
PV Unit	-1716.8000	2.9200	-5013.0560 (269)
Primary energy kwh/year			7400.0101 (272)
Primary energy kwh/m2/year			49.1303 (273)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2010 Edition
 Calculated by program Elmhurst Energy Systems Design SAP 2009 version 4.03r03

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) 16.89 kg/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 16.70 kg/m²OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.30 (max. 0.30)	0.33 (max. 0.70)	OK
Floor	0.21 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.62 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	9.00 (design value)	
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
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5 Cylinder insulation

Hot water storage	No cylinder
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6 Controls

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

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England):	Slight	OK
Based on:		
Overshading:	Average	
Windows facing North East:	9.02 m ² , No overhang	
Windows facing South East:	13.67 m ² , No overhang	
Windows facing South West:	5.95 m ² , No overhang	
Windows facing North West:	0.95 m ² , No overhang	
Ventilation rate:	8.00	
Blinds/curtains:	None	

10 Key features

SAP 2009 OVERHEATING ASSESSMENT FOR New Build (As Designed) BRE SAP Worksheet 9.90
 Calculated by program Elmhurst Energy Systems Design SAP 2009 version 4.03r03

Overheating Calculation Input Data

Dwelling type Detached House
 Number of storeys 2
 Cross ventilation possible Yes
 Region Southern England
 Front of dwelling faces South West
 Overshading Average or unknown
 Thermal mass parameter 100.0
 Night ventilation Yes
 Ventilation rate during hot weather (ach) 8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient 873.68 (P1)
 Transmission heat loss coefficient 142.88 (37)
 Summer heat loss coefficient 1016.56 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North East	0.000	1.000	None
South East	0.000	1.000	None
South East	1.000	0.360	Wide overhang
South West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
North East	1.000	1.00	1.000	1.000 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	0.360	0.260 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
South West	1.000	1.00	1.000	1.000 (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	6.0200	103.7976	0.6300	0.7000	0.9000	223.2068
South East	13.6700	121.3420	0.6300	0.7000	0.9000	592.5202
South West	4.1500	121.3420	0.6300	0.7000	0.9000	179.8799
North West	0.9500	103.7976	0.6300	0.7000	0.9000	35.2237

total: 1436.6211

	Jun	Jul	Aug	
Solar gains	1513	1437	1328	(P3)
Internal gains	592	568	581	
Total summer gains	2105	2005	1909	(P5)
Summer gain/loss ratio	2.07	1.97	1.88	(P6)
Summer external temperature	15.20	17.40	17.60	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	18.57	20.67	20.78	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

SAP 2009 IMPROVEMENTS

Calculated by program Elmhurst Energy Systems Design SAP 2009 version 4.03r03

sc0232

Current energy efficiency rating: B 83
 Current environmental impact rating: B 84

(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	SAP increase too small
O	Not considered
P	Not considered
Q	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic (PV) panels	Recommended
V Wind turbine	SAP increase too small

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic (PV) panels	+ 6.6	-£ 259	-908 kg (38.2%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.8	-£ 34	-171 kg (7.2%)
V Wind turbine	+ 0.2	-£ 9	-33 kg (2.2%)

	Typical annual savings	Energy efficiency	Environmental impact
Lower cost measures (none)			
Sub Total	£0	0.00 kg/m²	
Higher cost measures (none)			
Sub Total	£0	0.00 kg/m²	

Potential energy efficiency rating: B 83
 Potential environmental impact rating: B 84

Further improvements to achieve even higher standards

Solar photovoltaic	£259	6.03 kg/m²	B 90	B 90
Total Savings	£259	6.03 kg/m²		

Enhanced energy efficiency rating: B 90
 Enhanced environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 382 TEST (21 Aug 2015)
 Recommendation texts revision number 4.6 (10 Dec 2012)

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

	Current	Potential	Enhanced
Electricity	£103	£103	£103
Mains gas	£535	£535	£535
Space heating	£432	£432	£432
Water heating	£110	£110	£110
Lighting	£96	£96	£96
Generated (PV)	-£0	-£0	-£259
Total cost	£638	£638	£379
Carbon dioxide emissions	2.4 tonnes	2.4 tonnes	1.5 tonnes
Primary energy	82 kWh/m²	82 kWh/m²	49 kWh/m²

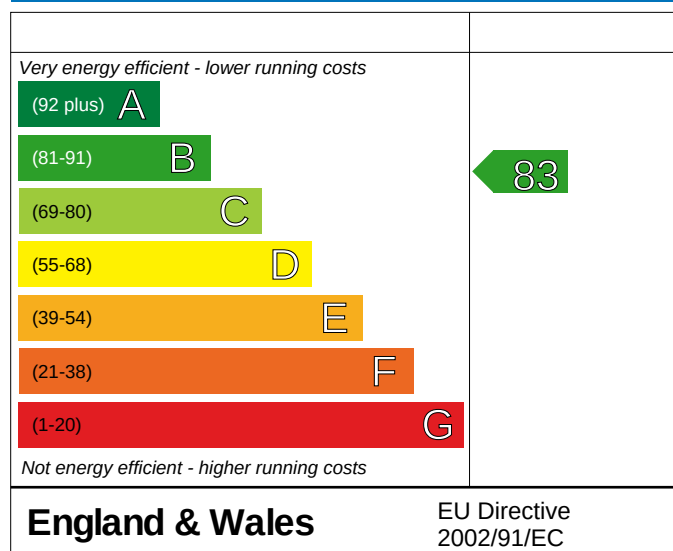
Barn Boathouse, Salterns Quay,
Mengham,
Hayling Island,
Hampshire

Dwelling type: House, Detached
Date of assessment: 07.Sep.2015
Produced by: SURECALC Limited
Total floor area: 150.62 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.

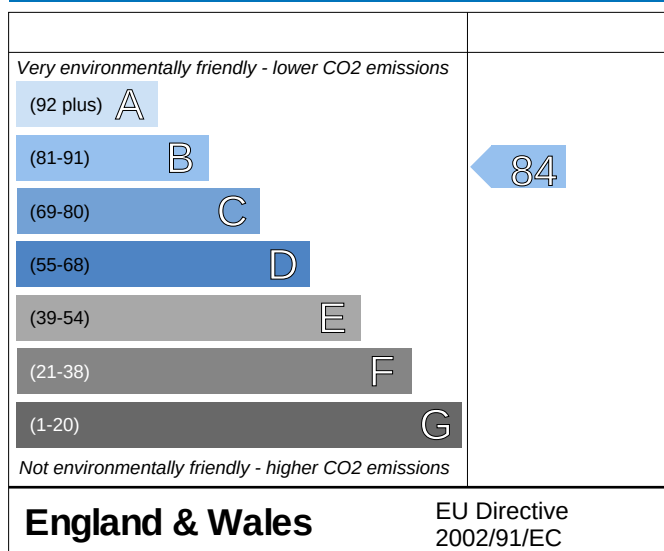
The energy performance has been assessed using the Government approved SAP2009 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

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.

Summary Information

Property Reference: sc0232

Issued on Date: 07.Sep.2015

Survey Reference: 001

Prop Type Ref: New Dwelling

Property: Barn Boathouse, Salterns Quay, Mengham, Hayling Island, Hampshire

SAP Rating: 83 B **CO2 Emissions (t/year):** 2.38 **DER:** 16.70 Pass **Reduction:** 1.1% **FEE:** 58.7 **ZC8:** 0.00
Environmental: 84 B **General Requirements Compliance:** Pass **TER:** 16.89 **HLP:** 1.43 **Energy cost:** £ 638

CfSH Results **Version:** **ENE1 Credits:** N/A **ENE2 Credits:** N/A **ENE7 Credits:** N/A **CfSH Level:** N/A

Surveyor: Mark Rogers, Tel: 023 9225 4347

Surveyor ID: A320-0001

Address: 2 St Jacques Way, Denmead, Waterlooville, Hants, PO7 6LA

Client: Martin Critchley Consultants

Software Version: Elmhurst Energy Systems SAP2009 Calculator (Design System) version 4.03r03

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)

Page 26 of 36

Orientation South West
1.0 Property Type House, Detached
2.0 Number of Storeys 2
3.0 Date Built 2015
3.0 Property Age Band
4.0 Sheltered Sides 2
5.0 Sunlight/Shade Average or unknown
6.0 Measurements

	Internal Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	37.39	76.52	2.33
1st Storey:	46.5	74.1	2.06

7.0 Living Area 61.88

8.0 Thermal Mass Parameter Simple calculation - Low

9.0 External Walls	Description	Construction	U-Value	Element	Kappa	Gross Area	Nett Area
External Wall	Other		0.29		0.00	104.48	77.81
Semi Exposed Garage	Other		0.32		0.00	14.05	12.14
Perimeter Stud	Other		0.33		0.00	32.02	32.02

10.0 External Roofs	Description	Construction	U-Value	Element	Kappa	Gross Area	Nett Area
External Roof	Other		0.15		0	55.22	55.22
Skilling Roof	Other		0.15		0	58.94	54.14

11.0 HeatLoss Floors	Description	Construction	U-Value	Element	Kappa	Area
Over Boathouse	Other		0.22		0	18.46
Ground Floor	Other		0.21		0	76.52

12.0 Opening Types	Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	Solar Trans	Frame Type	Frame Factor	U value
Doors	Manufacturer	Solid Door								1.80
Windows	Manufacturer	Window		Double Low-E Soft 0.05			0.63		0.70	1.60
Rooflights	Manufacturer	Roof Window		Double Low-E Soft 0.05			0.63		0.70	1.60

13.0 Openings	Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width	Height	Count	Area	Curtain Closed
Door to Garage	Solid Door - Doors	Semi Exposed Garage	North West	None		0	No	0	0	0	1.91	0
Ext Door SW	Solid Door - Doors	External Wall	South West	None		0	No	0	0	0	1.88	0
Windows SW	Window - Windows	External Wall	South West	None		0	No	0	0	0	4.15	0

Rooflights SW	Roof Window - Rooflights	Skilling Roof	South West	None	0	No	0	0	0	1.80	0
Window NW	Window - Windows	External Wall	North West	None	0	No	0	0	0	0.95	0
Window SE	Window - Windows	External Wall	South East	None	0	No	0	0	0	0.95	0
Windows SE	Window - Windows	External Wall	South East	None	1	Yes	0	0	0	12.72	0
Windows NE	Window - Windows	External Wall	North East	None	0	No	0	0	0	6.02	0
Rooflights NE	Roof Window - Rooflights	Skilling Roof	North East	None	0	No	0	0	0	3.00	0

14.0 Conservatory	None
15.0 Draught Proofing	100
16.0 Draught Lobby	No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Accredited	E2 Other lintels (including other steel lintels)	16.68	0.3	No
Table K1 - Accredited	E3 Sill	16.68	0.04	No
Table K1 - Accredited	E4 Jamb	35.76	0.05	No
Table K1 - Accredited	E5 Ground floor	37.39	0.16	No
Table K1 - Accredited	E6 Intermediate floor within a dwelling	46.50	0.07	No
Table K1 - Accredited	E10 Eaves (insulation at ceiling level)	33.28	0.06	No
Table K1 - Accredited	E11 Eaves (insulation at rafter level)	4.40	0.04	No
Table K1 - Accredited	E13 Gable (insulation at rafter level)	12.44	0.04	No
Table K1 - Accredited	E16 Corner (normal)	9.32	0.09	No

18.0 Pressure Testing	Yes
Designed q50	9.00
Property Tested ?	
As Built q50	
Same As Designed ?	

19.0 Mechanical Ventilation

Mechanical Ventilation System No

Present

Approved Installation

Windows open in hot weather Windows fully open

Cross ventilation possible

Night Ventilation Yes

Air change rate 8.00

Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

MVHR Duct Insulated

Manufacturer SFP

Duct Type

MVHR Efficiency

Wet Rooms

Brand, Model

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Cooling System No

22.0 Lighting

Internal

Total number of light fittings 24

Total number of L.E.L. fittings 18

Percentage of L.E.L. fittings 75.00

External

External lights fitted Yes

Light and motion sensors Yes

23.0 Electricity Tariff Standard

24.0 Heating Systems

Main Heating 1 Database

Description Gas Condensing Combi

Percentage of Heat 100.00

Main Heating 2	None
Description	
Percentage of Heat	
Community Heating	
Secondary Heating	
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery System	No
1 Waste Water Heat Recovery System	No
2 Solar Panel	No
25.0 Main Heating 1	
Database Ref. No.	10263
Fuel Type	Mains gas
Main Heating	Mains gas BGW Post 98 Combi condens. with auto ign.
TestMethod	
SAP Code	104
Efficiency (Split Efficiencies) %	
In Winter	90.9
In Summer	80.8
Model Name	
Manufacturer	
Controls	CBI Time and temperature zone control
Delayed Start Stat	Yes
Sap Code	2110
Burner Control	
Boiler Compensator	None
HETAS approved System	
Oil Pump Inside	
FI Case	
FI Water	
Flue Type	Balanced
Smoke Control Area	
Fan Assisted Flue	Yes
Is MHS Pumped	No pump
Heat Emitter	Radiators
Underfloor Heating	
Electric CPSU Temperature	
Combi boiler type	Standard Combi
Combi keep hot type	None
Combi store type	
27.0 Community Heating	
Space Community Heating	
Distribution Loss	
Distribution Loss Value	
Controls	
SAP Code	
Water Community Heating	
Distribution Loss	
Distribution Loss Value	
Charging Linked To Heat Use	
28.0 Secondary Heating	
Description	
SHS efficiency %	
SAP Code	
HETAS Approved System	
Smoke Control Area	
Test Method	
Manufacturer	
Model Name	
29.0 Water Heating	HWP From main heating 1
Water use <= 125 litres/person/day	Yes
SAP Code	901
Immersion Heater	
Summer Immersion	
Supplementary Immersion	
Immersion Only Heating Hot Water	
29.1 Flue Gas Heat Recovery System	
Database ID	
Brand Model	
Details	
29.2 Waste Water Heat Recovery	
System	
Total rooms with shower and/or bath	

30.0 Hot Water Cylinder
 Cylinder Stat
 Cylinder In Heated Space
 Independent Time Control
 Insulation Type
 Insulation Thickness
 Cylinder Volume
 Loss (kwh/day)
 Pipes insulation
 In Airing Cupboard

None

31.0 Solar Panel
 Solar Panel Area
 Area Type
 Panel Type
 n0, a1, A/G ratio
 Orientation
 Elevation
 Overshading
 Solar Storage Volume
 Pump electrically powered
 Combined Cylinder

32.0 Thermal Store
 Thermal Store Pipework

None
 within a single casing

33.0 Photovoltaic Unit
 Apportioned KWh/Year

34.0 Wind Turbines

Terrain Type
 Wind Turbines
 Count
 Apportioned Kwh/year
 Rotor Diameter
 Hub Height

Urban

35.0 Small-scale Hydro
 Electricity Generated
 Description
 Apportioned kWh/Year

Recommendations
 None

Further measures to achieve even higher standards

Solar photovoltaic panels, 2.5 kWp	£259	B 90	B 90
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Thermal Bridging

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Property Reference: sc0232

Issued on Date: 07.Sep.2015

Survey Reference: 001

Prop Type Ref: New Dwelling

Property: Barn Boathouse, Salterns Quay, Mengham, Hayling Island, Hampshire

SAP Rating: 83 B	CO2 Emissions (t/year): 2.38	DER: 16.70 Pass	Reduction: 1.1%	FEE: 58.7	ZC8: 0.00
Environmental: 84 B	General Requirements Compliance: Pass	TER: 16.89		HLP: 1.43	Energy cost: £ 638

CfSH Results	Version:	ENE1 Credits: N/A	ENE2 Credits: N/A	ENE7 Credits: N/A	CfSH Level: N/A
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Surveyor: Mark Rogers, Tel: 023 9225 4347

Surveyor ID: A320-0001

Address: 2 St Jacques Way, Denmead, Waterlooville, Hants, PO7 6LA

Client: Martin Critchley Consultants

Software Version: Elmhurst Energy Systems SAP2009 Calculator (Design System) version 4.03r03

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

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Accredited	0.300	16.68	5.00	
External wall	E3 Sill	Table K1 - Accredited	0.040	16.68	0.67	
External wall	E4 Jamb	Table K1 - Accredited	0.050	35.76	1.79	
External wall	E5 Ground floor	Table K1 - Accredited	0.160	37.39	5.98	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Accredited	0.070	46.50	3.26	
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Accredited	0.060	33.28	2.00	
External wall	E11 Eaves (insulation at rafter level)	Table K1 - Accredited	0.040	4.40	0.18	
External wall	E13 Gable (insulation at rafter level)	Table K1 - Accredited	0.040	12.44	0.50	
External wall	E16 Corner (normal)	Table K1 - Accredited	0.090	9.32	0.84	

Total W/mK: 20.21

Y-Value W/m2K: 0.056

U-value calculator report

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Property Reference: sc0232

Issued on Date: 07.Sep.2015

Survey Reference: 001

Type Ref: New Dwelling

Project: Barn Boathouse, Salterns Quay, Mengham, Hayling Island, Hampshire

SAP Rating: 83 B **CO2 Emissions (t/year):** 2.38 **DER:** 16.70 Pass **Reduction:** 1.1% **FEE:** 58.7 **ZC8:** 0.00
Environmental: 84 B **General Requirements Compliance:** Pass **TER:** 16.89 **HLP:** 1.43 **Energy cost:** £ 638

CfSH Results **Version:** **ENE1 Credits:** N/A **ENE2 Credits:** N/A **ENE7 Credits:** N/A **CfSH Level:** N/A

Surveyor: Mark Rogers, Tel: 023 9225 4347 **Surveyor ID:** A320-0001

Address: 2 St Jacques Way, Denmead, Waterlooville, Hants, PO7 6LA

Client: Martin Critchley Consultants

Software Version: Elmhurst Energy Systems Design SAP 2009 version 4.03r03

Building Elements:

Roof 000004 - Pitched Roof Insulated Ceiling

Roof Type: Pitched Roof, insulated flat ceiling					
Layer	Description	Thickness	Lambda	R	Fraction
Ext surface				0.040	
Layer 1	Roof space				
	Main construction	0 mm	0.000	0.000	100.00 %
Layer 2	Mineral wool				
	Main construction	150 mm	0.044	3.409	100.00 %
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 3	Mineral wool quilt				
	Main construction	150 mm	0.044	3.409	91.67 %
	Bridging - Timber	150 mm	0.130		8.33 %
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 4	Plasterboard, standard				
	Main construction	13 mm	0.210	0.060	100.00 %
Int surface				0.100	
Total resistance: Upper limit = 6.751 m ² K/W Lower limit = 6.540 m ² K/W Average = 6.646 m ² K/W U-value (unrounded) = 0.15 W/m ² K					
Unheated space: None					
Total thickness: 313 mm U-value: 0.15 W/m² K					

U-value calculator report

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Property Reference: sc0232

Issued on Date: 07.Sep.2015

Survey Reference: 001

Type Ref: New Dwelling

Project: Barn Boathouse, Salterns Quay, Mengham, Hayling Island, Hampshire

SAP Rating: 83 B **CO2 Emissions (t/year):** 2.38 **DER:** 16.70 Pass **Reduction:** 1.1% **FEE:** 58.7 **ZC8:** 0.00
Environmental: 84 B **General Requirements Compliance:** Pass **TER:** 16.89 **HLP:** 1.43 **Energy cost:** £ 638

CfSH Results **Version:** **ENE1 Credits:** N/A **ENE2 Credits:** N/A **ENE7 Credits:** N/A **CfSH Level:** N/A

Surveyor: Mark Rogers, Tel: 023 9225 4347 **Surveyor ID:** A320-0001

Address: 2 St Jacques Way, Denmead, Waterlooville, Hants, PO7 6LA

Client: Martin Critchley Consultants

Software Version: Elmhurst Energy Systems Design SAP 2009 version 4.03r03

Building Elements:

Roof 000005 - Pitched Roof Skilling

Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness	Lambda	R	Fraction
Ext surface				0.040	
Layer 1	Tiles, clay				
	Main construction	15 mm	1.000	0.015	100.00 %
Layer 2	airspace/timber battens				
	Main construction	25 mm	0.100	0.250	89.63 %
	Bridging - Timber	25 mm	0.156		10.37 %
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	Air layer unventilated				
	Main construction	50 mm	0.147	0.339	87.50 %
	Bridging - Timber	50 mm	0.130		12.50 %
	Corrections - Cavity Unventilated, Emissivity: Low 0.2				
Layer 4	Celotex GA4000				
	Main construction	50 mm	0.022	2.273	87.50 %
	Bridging - Timber	50 mm	0.130		12.50 %
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	Celotex CW4000				
	Main construction	90 mm	0.022	4.091	100.00 %
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 6	Plasterboard, standard				
	Main construction	13 mm	0.210	0.060	100.00 %
Int surface				0.100	
Total resistance: Upper limit = 6.857 m ² K/W Lower limit = 6.294 m ² K/W Average = 6.576 m ² K/W U-value (unrounded) = 0.15 W/m ² K					

Unheated space: None

Total thickness: 243 mm

U-value: 0.15 W/m² K

U-value calculator report

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Property Reference: sc0232

Issued on Date: 07.Sep.2015

Survey Reference: 001

Type Ref: New Dwelling

Project: Barn Boathouse, Salterns Quay, Mengham, Hayling Island, Hampshire

SAP Rating: 83 B **CO2 Emissions (t/year):** 2.38 **DER:** 16.70 Pass **Reduction:** 1.1% **FEE:** 58.7 **ZC8:** 0.00
Environmental: 84 B **General Requirements Compliance:** Pass **TER:** 16.89 **HLP:** 1.43 **Energy cost:** £ 638

CfSH Results **Version:** **ENE1 Credits:** N/A **ENE2 Credits:** N/A **ENE7 Credits:** N/A **CfSH Level:** N/A

Surveyor: Mark Rogers, Tel: 023 9225 4347 **Surveyor ID:** A320-0001

Address: 2 St Jacques Way, Denmead, Waterlooville, Hants, PO7 6LA

Client: Martin Critchley Consultants

Software Version: Elmhurst Energy Systems Design SAP 2009 version 4.03r03

Building Elements:

Wall 000001 - Timber frame Weather Boarded Stud

Layer	Description	Thickness	Lambda	R	Fraction
Ext surface				0.040	
Layer 1	Softwood, dry				
	Main construction	13 mm	0.130	0.100	100.00 %
Layer 2	airspace/timber battens				
	Main construction	22 mm	0.122	0.180	89.63 %
	Bridging - Timber	22 mm	0.124		10.37 %
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	Plywood				
	Main construction	12 mm	0.130	0.092	100.00 %
Layer 4	Celotex GA4000				
	Main construction	90 mm	0.022	4.091	87.50 %
	Bridging - Timber	90 mm	0.130		12.50 %
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	Standard cavity				
	Main construction	10 mm	0.067	0.150	87.50 %
	Bridging - Timber	10 mm	0.130		12.50 %
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 6	Plasterboard, standard				
	Main construction	13 mm	0.210	0.060	100.00 %
Int surface				0.130	
Total resistance: Upper limit = 3.729 m ² K/W Lower limit = 3.271 m ² K/W Average = 3.500 m ² K/W U-value (unrounded) = 0.29 W/m ² K					
Unheated space: None					
Total thickness: 160 mm U-value: 0.29 W/m² K					

U-value calculator report

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Property Reference: sc0232

Issued on Date: 07.Sep.2015

Survey Reference: 001

Type Ref: New Dwelling

Project: Barn Boathouse, Salterns Quay, Mengham, Hayling Island, Hampshire

SAP Rating: 83 B **CO2 Emissions (t/year):** 2.38 **DER:** 16.70 Pass **Reduction:** 1.1% **FEE:** 58.7 **ZC8:** 0.00
Environmental: 84 B **General Requirements Compliance:** Pass **TER:** 16.89 **HLP:** 1.43 **Energy cost:** £ 638

CfSH Results **Version:** **ENE1 Credits:** N/A **ENE2 Credits:** N/A **ENE7 Credits:** N/A **CfSH Level:** N/A

Surveyor: Mark Rogers, Tel: 023 9225 4347 **Surveyor ID:** A320-0001

Address: 2 St Jacques Way, Denmead, Waterlooville, Hants, PO7 6LA

Client: Martin Critchley Consultants

Software Version: Elmhurst Energy Systems Design SAP 2009 version 4.03r03

Building Elements:

Wall 000002 - Timber frame Stud

Layer	Description	Thickness	Lambda	R	Fraction
Ext surface				0.040	
Layer 1	Plasterboard, standard				
	Main construction	13 mm	0.210	0.060	100.00 %
Layer 2	Celotex GA4000				
	Main construction	90 mm	0.022	4.091	87.50 %
	Bridging - Timber	90 mm	0.130		12.50 %
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Standard cavity				
	Main construction	10 mm	0.056	0.180	87.50 %
	Bridging - Timber	10 mm	0.130		12.50 %
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 4	Plasterboard, standard				
	Main construction	13 mm	0.210	0.060	100.00 %
Int surface				0.130	
Total resistance: Upper limit = 3.318 m ² K/W Lower limit = 2.978 m ² K/W Average = 3.148 m ² K/W U-value (unrounded) = 0.32 W/m ² K					
Unheated space: None					
Total thickness: 125 mm U-value: 0.32 W/m² K					

U-value calculator report

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Property Reference: sc0232

Issued on Date: 07.Sep.2015

Survey Reference: 001

Type Ref: New Dwelling

Project: Barn Boathouse, Salterns Quay, Mengham, Hayling Island, Hampshire

SAP Rating: 83 B **CO2 Emissions (t/year):** 2.38 **DER:** 16.70 Pass **Reduction:** 1.1% **FEE:** 58.7 **ZC8:** 0.00
Environmental: 84 B **General Requirements Compliance:** Pass **TER:** 16.89 **HLP:** 1.43 **Energy cost:** £ 638

CfSH Results **Version:** **ENE1 Credits:** N/A **ENE2 Credits:** N/A **ENE7 Credits:** N/A **CfSH Level:** N/A

Surveyor: Mark Rogers, Tel: 023 9225 4347 **Surveyor ID:** A320-0001

Address: 2 St Jacques Way, Denmead, Waterlooville, Hants, PO7 6LA

Client: Martin Critchley Consultants

Software Version: Elmhurst Energy Systems Design SAP 2009 version 4.03r03

Building Elements:

Wall 000003 - Timber frame Perimeter Stud

Layer	Description	Thickness	Lambda	R	Fraction
Ext surface				0.040	
Layer 1	Celotex GA4000				
	Main construction	90 mm	0.022	4.091	87.50 %
	Bridging - Timber	90 mm	0.130		12.50 %
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 2	Standard cavity				
	Main construction	10 mm	0.067	0.150	87.50 %
	Bridging - Timber	10 mm	0.130		12.50 %
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	Plasterboard, standard				
	Main construction	13 mm	0.210	0.060	100.00 %
Int surface				0.130	
Total resistance: Upper limit = 3.186 m ² K/W Lower limit = 2.899 m ² K/W Average = 3.043 m ² K/W U-value (unrounded) = 0.33 W/m ² K					
Unheated space: None					
Total thickness: 113 mm U-value: 0.33 W/m² K					

Floor 000006 - Floor Over Garage

Floor Type: Exposed Floor					
Layer	Description	Thickness	Lambda	R	Fraction
Ext surface				0.040	
Layer 1	Plasterboard, standard				
	Main construction	12 mm	0.210	0.057	100.00 %
Layer 2	Earthwool Rafter Roll (175mm to 200mm)				
	Main construction	200 mm	0.036	5.556	87.50 %
	Bridging - Timber	200 mm	0.130		12.50 %
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Chipboard				
	Main construction	18 mm	0.130	0.138	100.00 %
Int surface				0.170	
Total resistance: Upper limit = 4.738 m ² K/W Lower limit = 4.594 m ² K/W Average = 4.666 m ² K/W U-value (unrounded) = 0.22 W/m ² K					
Unheated space: None					
Total thickness: 230 mm U-value: 0.22 W/m² K					

U-value calculator report

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Property Reference: sc0232

Issued on Date: 07.Sep.2015

Survey Reference: 001

Type Ref: New Dwelling

Project: Barn Boathouse, Salterns Quay, Mengham, Hayling Island, Hampshire

SAP Rating: 83 B **CO2 Emissions (t/year):** 2.38 **DER:** 16.70 Pass **Reduction:** 1.1% **FEE:** 58.7 **ZC8:** 0.00
Environmental: 84 B **General Requirements Compliance:** Pass **TER:** 16.89 **HLP:** 1.43 **Energy cost:** £ 638

CfSH Results **Version:** **ENE1 Credits:** N/A **ENE2 Credits:** N/A **ENE7 Credits:** N/A **CfSH Level:** N/A

Surveyor: Mark Rogers, Tel: 023 9225 4347 **Surveyor ID:** A320-0001

Address: 2 St Jacques Way, Denmead, Waterlooville, Hants, PO7 6LA

Client: Martin Critchley Consultants

Software Version: Elmhurst Energy Systems Design SAP 2009 version 4.03r03

Building Elements:

Floor 000007 - Ground Floor Solid

Floor Type: Slab On Ground Floor
 Area = 76.52 m², Perimeter = 37.39 m, Wall thickness = 300.00 mm, Soil: Unknown
 Horizontal edge insulation: none
 Vertical edge insulation: none

Layer	Description	Thickness	Lambda	R	Fraction
Ext surface				0.040	
Layer 1	Concrete, medium density				
	Main construction	250 mm	1.350	0.185	100.00 %
Layer 2	Celotex GA4000				
	Main construction	70 mm	0.022	3.182	100.00 %
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Screed				
	Main construction	65 mm	1.150	0.057	100.00 %
Int surface				0.170	

Total resistance: Upper limit = 3.424 m² K/W Lower limit = 3.424 m² K/W Average = 3.424 m² K/W
 U-value (unrounded) = 0.21 W/m² K

Unheated space: None

Total thickness: 385 mm

U-value: 0.21 W/m² K