L1A 2013 - Regulations Compliance Report
Design - Final

This design final submission provides evidence towards compliance with Part L of the Building Regulations, in accordance with Appendix C of AD L1A. It has been carried out by an On-Construction Domestic Energy Assessor and can be accepted for Building Control purposes without further checking. It has been prepared from plans and specifications and may not reflect the 'as built' property.This report covers only items included within the SAP and is not a complete report of regulations compliance.

Assessor name	Mr David Beard	Assessor number	3672
Client		Last modified	12/10/2015
Address	Plot 2 Heath House Lane, Hedge End, SO30 0LB		

Check	Evidence	Produced by	OK?
Criterion 1: predicted carbon dioxide emission from proposed dwelling does not exceed the target			
TER (kg $CO_2/m^2.a$)	Fuel = N/A Fuel factor = 1.00 TER = 14.90	Authorised SAP Assessor	
DER for dwelling as designed (kg $CO_2/m^2.a$)	DER = 10.36	Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to the target?	DER 10.36 < TER 14.90	Authorised SAP Assessor	Passed
Is the fabric energy efficiency of the dwellling as designed less than or equal to the target?	DFEE 49.59 < TFEE 56.08	Authorised SAP Assessor	Passed
Criterion 2: the performance of the building fabric and the heating, hot water and fixed lighting systems should be no worse than the design limits			
Fabric U-values			
Are all U-values better than the design limits in Table 2?	**Element** / **Weighted average** / **Highest** Wall: 0.18 (max 0.30) / 0.18 (max 0.70) Party wall: (no party wall) Floor: 0.13 (max 0.25) / 0.13 (max 0.70) Roof: 0.13 (max 0.20) / 0.13 (max 0.35) Openings: 1.38 (max 2.00) / 1.40 (max 3.30)	Authorised SAP Assessor	Passed
Thermal bridging			
How has the loss from thermal bridges been calculated?	Thermal bridging calculated from linear thermal transmittances for each junction	Authorised SAP Assessor	
Heating and hot water systems			
Does the efficiency of the heating systems meet the minimum value set out in the Domestic Heating Compliance Guide?	Main heating system: Mains gas, Regular boiler A Data from manufacturer Efficiency = 88.00% 2009 SEDBUK Minimum = 88.00% Secondary heating system: Room heaters - Wood logs Closed room heater Efficiency = 65.00% Minimum = 65.00%	Authorised SAP Assessor	Passed
Does the insulation of the hot water cylinder meet the standards set out in the Domestic Heating Compliance Guide?	Cylinder volume = 140.00 litres Nominal cylinder loss = 1.37kWh/day Maximum permitted cylinder loss = 1.81kWh/day Primary hot water pipes are insulated	Authorised SAP Assessor	Passed

Check	Evidence	Produced by	OK?
Do controls meet the minimum controls provision set out in the Domestic Heating Compliance Guide?	Space heating control: Time and temperature zone control - plumbing circuit Hot water control: Boiler interlock (main system 1) Cylinder thermostat Separate water control	Authorised SAP Assessor	Passed
Fixed internal lighting			
Does fixed internal lighting comply with paragraphs 42 to 44?	Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 18 Percentage of low energy lights = 100% Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has appropriate passive control measures to limit solar gains			
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant (18.24°) Overheating risk (July) = Not significant (20.05°) Overheating risk (August) = Not significant (19.97°) Region = S England Thermal mass parameter = 100.00 Ventilation rate in hot weather = 8.00 ach Blinds/curtains = None	Authorised SAP Assessor	Passed
Criterion 4: the performance of the dwelling, as designed, is consistent with the DER			
Design air permeability ($m^3/(h.m^2)$ at 50Pa)	Design air permeability = 5.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Not applicable	Authorised SAP Assessor	
Have the key features of the design been included (or bettered) in practice?	Secondary heating system present - Wood logs Use of the following low carbon or renewable technologies: • Wood logs used for secondary heating • Photovoltaic array	Authorised SAP Assessor	

DER Worksheet
Design - Final

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Assessor name	Mr David Beard	Assessor number	3672
Client		Last modified	12/10/2015
Address	Plot 2 Heath House Lane, Hedge End, SO30 0LB		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		94.04	(1a)	x	2.40	(2a)	=	225.70	(3a)
+1		91.16	(1b)	x	2.60	(2b)	=	237.02	(3b)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	185.20	(4)						
Dwelling volume						(3a) + (3b) + (3c) + (3d)...(3n) =		462.71	(5)

2. Ventilation rate

			m³ per hour	
Number of chimneys	1	x 40 =	40	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent fans	6	x 10 =	60	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	100	÷ (5) =	0.22	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	5.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.47	(18)
Number of sides on which the dwelling is sheltered	1	(19)
Shelter factor	1 - [0.075 x (19)] = 0.93	(20)
Infiltration rate incorporating shelter factor	(18) x (20) = 0.43	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.55	0.54	0.53	0.47	0.46	0.41	0.41	0.40	0.43	0.46	0.49	0.51	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)

d) natural ventilation or whole house positive input ventilation from loft

	0.65	0.65	0.64	0.61	0.61	0.58	0.58	0.58	0.59	0.61	0.62	0.63	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.65	0.65	0.64	0.61	0.61	0.58	0.58	0.58	0.59	0.61	0.62	0.63	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²		U-value W/m²K		A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K	
Door			3.90	x	1.20	=	4.68			(26)
Window			33.11	x	1.33	=	43.90			(27)
Roof window			0.86	x	1.33	=	1.14			(27a)
Ground floor			94.04	x	0.13	=	12.23			(28a)
External wall			180.85	x	0.18	=	32.55			(29a)
Roof			99.24	x	0.13	=	12.90			(30)
Total area of external elements ∑A, m²			412.00							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	107.40 (33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m²K		100.00 (35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		26.29 (36)
Total fabric heat loss	(33) + (36) =	133.68 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)													
	99.42	98.52	97.65	93.52	92.75	89.16	89.16	88.49	90.54	92.75	94.31	95.94	(38)
Heat transfer coefficient, W/K (37)m + (38)m													
	233.10	232.20	231.33	227.20	226.43	222.84	222.84	222.17	224.22	226.43	227.99	229.62	
Average = ∑(39)1...12/12 =												227.20	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)													
	1.26	1.25	1.25	1.23	1.22	1.20	1.20	1.20	1.21	1.22	1.23	1.24	
Average = ∑(40)1...12/12 =												1.23	(40)
Number of days in month (Table 1a)													
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	2.98 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	105.04 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
	115.54	111.34	107.14	102.94	98.74	94.53	94.53	98.74	102.94	107.14	111.34	115.54	
∑(44)1...12 =												1260.45	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)													
	171.34	149.86	154.64	134.82	129.36	111.63	103.44	118.70	120.12	139.99	152.81	165.94	
∑(45)1...12 =												1652.65	(45)
Distribution loss 0.15 x (45)m													
	25.70	22.48	23.20	20.22	19.40	16.74	15.52	17.81	18.02	21.00	22.92	24.89	(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel	140.00 (47)
Water storage loss:	
b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.01 (51)
Volume factor from Table 2a	0.95 (52)
Temperature factor from Table 2b	0.54 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.74 (54)
Enter (50) or (54) in (55)	0.74 (55)

Water storage loss calculated for each month (55) x (41)m

22.90	20.69	22.90	22.17	22.90	22.17	22.90	22.90	22.17	22.90	22.17	22.90	(56)

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)

22.90	20.69	22.90	22.17	22.90	22.17	22.90	22.90	22.17	22.90	22.17	22.90	(57)

Primary circuit loss for each month from Table 3

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

217.51	191.56	200.81	179.50	175.53	156.31	149.61	164.87	164.80	186.15	197.48	212.10	(62)

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

217.51	191.56	200.81	179.50	175.53	156.31	149.61	164.87	164.80	186.15	197.48	212.10	

∑(64)1...12 = 2196.22 (64)

Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

93.91	83.19	88.35	80.57	79.95	72.86	71.33	76.40	75.68	83.48	86.55	92.11	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.36	28.75	23.38	17.70	13.23	11.17	12.07	15.69	21.05	26.73	31.20	33.26	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	356.75	360.45	351.13	331.27	306.20	282.63	266.89	263.19	272.52	292.38	317.45	341.01	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	(71)
Water heating gains (Table 5)	126.22	123.79	118.75	111.90	107.45	101.19	95.87	102.69	105.11	112.20	120.21	123.80	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	586.07	583.73	563.99	531.61	497.62	465.74	445.57	452.31	469.43	502.06	539.60	568.82	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
South	0.77	x	15.76	x	46.75	x 0.9 x	0.63	x	0.70	=	225.18	(78)
North	0.77	x	11.19	x	10.63	x 0.9 x	0.63	x	0.70	=	36.36	(74)
West	0.77	x	1.18	x	19.64	x 0.9 x	0.63	x	0.70	=	7.08	(80)
East	0.77	x	1.18	x	19.64	x 0.9 x	0.63	x	0.70	=	7.08	(76)
NorthEast	0.77	x	1.90	x	11.28	x 0.9 x	0.63	x	0.70	=	6.55	(75)
NorthWest	0.77	x	1.90	x	11.28	x 0.9 x	0.63	x	0.70	=	6.55	(81)
East	1.00	x	0.86	x	26.61	x 0.9 x	0.63	x	0.70	=	9.08	(76)

Solar gains in watts ∑(74)m...(82)m

297.89	511.02	713.27	914.71	1058.12	1066.65	1021.53	911.12	782.00	568.15	357.35	254.64	(83)

Total gains - internal and solar (73)m + (83)m

883.97	1094.75	1277.26	1446.32	1555.74	1532.39	1467.10	1363.43	1251.43	1070.20	896.96	823.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)												
0.98	0.97	0.94	0.89	0.81	0.69	0.56	0.61	0.79	0.92	0.97	0.98	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)												
18.19	18.50	18.99	19.63	20.21	20.65	20.85	20.82	20.47	19.71	18.84	18.15	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(˚C)												
19.87	19.88	19.88	19.90	19.90	19.92	19.92	19.92	19.91	19.90	19.90	19.89	(88)
Utilisation factor for gains for rest of dwelling n2,m												
0.98	0.96	0.93	0.87	0.78	0.62	0.46	0.50	0.73	0.90	0.96	0.98	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)												
16.11	16.57	17.28	18.20	19.01	19.59	19.82	19.79	19.37	18.33	17.07	16.06	(90)

Living area fraction — Living area ÷ (4) = 0.13 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

16.38	16.83	17.51	18.39	19.17	19.73	19.96	19.93	19.52	18.51	17.31	16.34	(92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

16.38	16.83	17.51	18.39	19.17	19.73	19.96	19.93	19.52	18.51	17.31	16.34	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												
0.96	0.94	0.90	0.84	0.74	0.61	0.46	0.51	0.71	0.87	0.94	0.97	(94)
Useful gains, ηmGm, W (94)m x (84)m												
848.74	1025.56	1151.04	1214.49	1158.34	929.93	675.18	688.83	883.70	929.23	844.49	795.32	(95)
Monthly average external temperature from Table U1												
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]												
2816.89	2769.42	2546.35	2156.68	1690.65	1144.16	748.28	783.59	1215.46	1791.81	2327.83	2787.17	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m												
1464.30	1171.87	1038.11	678.37	396.04	0.00	0.00	0.00	0.00	641.76	1068.00	1481.94	

∑(98)1...5, 10...12 = 7940.39 (98)

Space heating requirement kWh/m²/year — (98) ÷ (4) = 42.87 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11) 0.10 (201)

Fraction of space heat from main system(s) — 1 - (201) = 0.90 (202)

Fraction of space heat from main system 2 0.00 (202)

Fraction of total space heat from main system 1 — (202) x [1- (203)] = 0.90 (204)

Fraction of total space heat from main system 2 — (202) x (203) = 0.00 (205)

Efficiency of main system 1 (%) 88.90 (206)

Efficiency of secondary/supplementary system (%) 65.00 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Space heating fuel (main system 1), kWh/month

1482.42	1186.37	1050.96	686.77	400.94	0.00	0.00	0.00	0.00	649.70	1081.22	1500.28

∑(211)1...5, 10...12 = 8038.64 (211)

Space heating fuel (secondary), kWh/month

225.28	180.29	159.71	104.37	60.93	0.00	0.00	0.00	0.00	98.73	164.31	227.99

∑(215)1...5, 10...12 = 1221.60 (215)

Water heating

Efficiency of water heater

87.31	87.18	86.93	86.38	85.29	78.80	78.80	78.80	78.80	86.21	87.00	87.36

(217)

Water heating fuel, kWh/month

249.11	219.72	231.00	207.79	205.80	198.36	189.86	209.22	209.13	215.94	226.99	242.78

∑(219a)1...12 = 2605.71 (219)

Annual totals

Space heating fuel - main system 1	8038.64	
Space heating fuel - secondary	1221.60	
Water heating fuel	2605.71	
Electricity for pumps, fans and electric keep-hot (Table 4f)		
central heating pump or water pump within warm air heating unit	30.00	(230c)
boiler flue fan	45.00	(230e)
Total electricity for the above, kWh/year	75.00	(231)
Electricity for lighting (Appendix L)	571.55	(232)
Energy saving/generation technologies		
electricity generated by PV (Appendix M)	-1424.97	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =	11087.53	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	8038.64	x	3.48	x 0.01 =	279.74	(240)
Space heating - secondary	1221.60	x	4.23	x 0.01 =	51.67	(242)
Water heating	2605.71	x	3.48	x 0.01 =	90.68	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	571.55	x	13.19	x 0.01 =	75.39	(250)
Additional standing charges					120.00	(251)
Energy saving/generation technologies						
pv savings	-1424.97	x	13.19	x 0.01 =	-187.95	(252)
Total energy cost			(240)...(242) + (245)...(254) =		439.42	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	0.80	(257)
SAP value	88.82	
SAP rating (section 13)	89	(258)
SAP band	B	

12a. CO_2 emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating - main system 1	8038.64	x	0.22	=	1736.35	(261)
Space heating - secondary	1221.60	x	0.02	=	23.21	(263)

Water heating	2605.71	x	0.22	=	562.83	(264)
Space and water heating			(261) + (262) + (263) + (264) =		2322.39	(265)
Pumps and fans	75.00	x	0.52	=	38.93	(267)
Electricity for lighting	571.55	x	0.52	=	296.64	(268)
Energy saving/generation technologies						
pv savings	-1424.97	x	0.52	=	-739.56	(269)
Total CO_2, kg/year				(265)...(271) =	1918.39	(272)
Dwelling CO_2 emission rate				(272) ÷ (4) =	10.36	(273)
EI value					88.83	
EI rating (section 14)					89	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	8038.64	x	1.22	=	9807.14	(261)
Space heating - secondary	1221.60	x	1.04	=	1270.46	(263)
Water heating	2605.71	x	1.22	=	3178.96	(264)
Space and water heating			(261) + (262) + (263) + (264) =		14256.57	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	571.55	x	3.07	=	1754.67	(268)
Energy saving/generation technologies						
Electricity generated - PVs	-1424.97	x	3.07	=	-4374.67	(269)
Primary energy kWh/year					11866.83	(272)
Dwelling primary energy rate kWh/m2/year					64.08	(273)

DFEE Worksheet
Design - Final

This design submission has been carried out by an On-Construction Domestic Energy Assessor. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr David Beard	Assessor number	3672
Client		Last modified	12/10/2015
Address	Plot 2 Heath House Lane, Hedge End, SO30 0LB		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		94.04	(1a)	x	2.40	(2a)	=	225.70	(3a)
+1		91.16	(1b)	x	2.60	(2b)	=	237.02	(3b)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	185.20	(4)						
Dwelling volume						(3a) + (3b) + (3c) + (3d)...(3n) =		462.71	(5)

2. Ventilation rate

				m³ per hour	
Number of chimneys		1	x 40 =	40	(6a)
Number of open flues		0	x 20 =	0	(6b)
Number of intermittent fans		4	x 10 =	40	(7a)
Number of passive vents		0	x 10 =	0	(7b)
Number of flueless gas fires		0	x 40 =	0	(7c)
				Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	80	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.42	(18)
Number of sides on which the dwelling is sheltered		1	(19)
Shelter factor	1 - [0.075 x (19)] =	0.93	(20)
Infiltration rate incorporating shelter factor	(18) x (20) =	0.39	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2													
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4													
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m													
	0.50	0.49	0.48	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.44	0.46	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)

d) natural ventilation or whole house positive input ventilation from loft

0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.57	0.58	0.59	0.60	0.61	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.57	0.58	0.59	0.60	0.61

(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²		U-value W/m²K		A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K	
Door			3.90	x	1.20	=	4.68			(26)
Window			33.11	x	1.33	=	43.90			(27)
Roof window			0.86	x	1.33	=	1.14			(27a)
Ground floor			94.04	x	0.13	=	12.23			(28a)
External wall			180.85	x	0.18	=	32.55			(29a)
Roof			99.24	x	0.13	=	12.90			(30)
Total area of external elements ∑A, m²			412.00							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	107.40 (33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m²K		100.00 (35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		26.29 (36)
Total fabric heat loss	(33) + (36) =	133.68 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)													
	95.34	94.60	93.88	90.48	89.85	86.89	86.89	86.34	88.03	89.85	91.13	92.48	(38)
Heat transfer coefficient, W/K (37)m + (38)m													
	229.02	228.28	227.56	224.16	223.53	220.57	220.57	220.02	221.71	223.53	224.81	226.16	
									Average = ∑(39)1...12/12 =			224.16	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)													
	1.24	1.23	1.23	1.21	1.21	1.19	1.19	1.19	1.20	1.21	1.21	1.22	
									Average = ∑(40)1...12/12 =			1.21	(40)
Number of days in month (Table 1a)													
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	2.98 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	105.04 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
	115.54	111.34	107.14	102.94	98.74	94.53	94.53	98.74	102.94	107.14	111.34	115.54	
										∑(44)1...12 =		1260.45	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)													
	171.34	149.86	154.64	134.82	129.36	111.63	103.44	118.70	120.12	139.99	152.81	165.94	
										∑(45)1...12 =		1652.65	(45)
Distribution loss 0.15 x (45)m													
	25.70	22.48	23.20	20.22	19.40	16.74	15.52	17.81	18.02	21.00	22.92	24.89	(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel	140.00 (47)
Water storage loss:	
b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.01 (51)
Volume factor from Table 2a	0.95 (52)
Temperature factor from Table 2b	0.54 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.74 (54)
Enter (50) or (54) in (55)	0.74 (55)

Water storage loss calculated for each month (55) x (41)m

22.90	20.69	22.90	22.17	22.90	22.17	22.90	22.90	22.17	22.90	22.17	22.90	(56)

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)

22.90	20.69	22.90	22.17	22.90	22.17	22.90	22.90	22.17	22.90	22.17	22.90	(57)

Primary circuit loss for each month from Table 3

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

217.51	191.56	200.81	179.50	175.53	156.31	149.61	164.87	164.80	186.15	197.48	212.10	(62)

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

171.34	149.86	154.64	134.82	129.36	111.63	103.44	118.70	120.12	139.99	152.81	165.94	

∑(64)1...12 = 1652.65 (64)

Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

36.41	31.84	32.86	28.65	27.49	23.72	21.98	25.22	25.53	29.75	32.47	35.26	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.36	28.75	23.38	17.70	13.23	11.17	12.07	15.69	21.05	26.73	31.20	33.26	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	356.75	360.45	351.13	331.27	306.20	282.63	266.89	263.19	272.52	292.38	317.45	341.01	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	(69)
Pump and fan gains (Table 5a)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evaporation (Table 5)	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	(71)
Water heating gains (Table 5)	48.94	47.39	44.17	39.79	36.95	32.95	29.54	33.90	35.45	39.98	45.10	47.39	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	505.79	504.33	486.41	456.49	424.11	394.49	376.25	380.52	396.77	426.84	461.49	489.41	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
South	0.77	x	15.76	x	46.75	x 0.9 x	0.63	x	0.70	=	225.18	(78)
North	0.77	x	11.19	x	10.63	x 0.9 x	0.63	x	0.70	=	36.36	(74)
West	0.77	x	1.18	x	19.64	x 0.9 x	0.63	x	0.70	=	7.08	(80)
East	0.77	x	1.18	x	19.64	x 0.9 x	0.63	x	0.70	=	7.08	(76)
NorthEast	0.77	x	1.90	x	11.28	x 0.9 x	0.63	x	0.70	=	6.55	(75)
NorthWest	0.77	x	1.90	x	11.28	x 0.9 x	0.63	x	0.70	=	6.55	(81)
East	1.00	x	0.86	x	26.61	x 0.9 x	0.63	x	0.70	=	9.08	(76)

Solar gains in watts ∑(74)m...(82)m

297.89	511.02	713.27	914.71	1058.12	1066.65	1021.53	911.12	782.00	568.15	357.35	254.64	(83)

Total gains - internal and solar (73)m + (83)m

803.69	1015.35	1199.68	1371.21	1482.23	1461.14	1397.77	1291.65	1178.77	994.98	818.85	744.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)												
0.98	0.97	0.95	0.90	0.83	0.71	0.58	0.63	0.80	0.93	0.97	0.99	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)												
18.16	18.48	18.97	19.61	20.19	20.64	20.85	20.81	20.45	19.68	18.80	18.11	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(˚C)												
19.89	19.89	19.90	19.91	19.91	19.93	19.93	19.93	19.92	19.91	19.91	19.90	(88)
Utilisation factor for gains for rest of dwelling n2,m												
0.98	0.97	0.94	0.89	0.79	0.64	0.47	0.52	0.75	0.91	0.97	0.98	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)												
17.29	17.60	18.09	18.73	19.28	19.69	19.86	19.83	19.54	18.80	17.94	17.25	(90)

Living area fraction — Living area ÷ (4) = 0.13 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

17.40	17.72	18.21	18.84	19.41	19.82	19.99	19.96	19.66	18.92	18.06	17.36	(92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.40	17.72	18.21	18.84	19.41	19.82	19.99	19.96	19.66	18.92	18.06	17.36	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												
0.97	0.95	0.92	0.86	0.77	0.63	0.48	0.53	0.73	0.89	0.96	0.98	(94)
Useful gains, ηmGm, W (94)m x (84)m												
781.55	967.28	1104.70	1182.99	1139.21	919.03	668.68	680.73	864.99	888.53	784.27	726.89	(95)
Monthly average external temperature from Table U1												
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]												
3000.65	2926.72	2664.65	2229.10	1722.31	1151.59	747.45	784.16	1232.27	1860.00	2463.10	2977.36	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m												
1651.01	1316.75	1160.60	753.20	433.83	0.00	0.00	0.00	0.00	722.77	1208.76	1674.35	

∑(98)1...5, 10...12 = 8921.26 (98)

Space heating requirement kWh/m²/year — (98) ÷ (4) = 48.17 (99)

8c. Space cooling requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm												
0.00	0.00	0.00	0.00	0.00	2073.38	1632.23	1672.19	0.00	0.00	0.00	0.00	(100)
Utilisation factor for loss ηm												
0.00	0.00	0.00	0.00	0.00	0.67	0.74	0.71	0.00	0.00	0.00	0.00	(101)
Useful loss ηmLm (watts) (100)m x (101)m												
0.00	0.00	0.00	0.00	0.00	1396.20	1215.52	1189.78	0.00	0.00	0.00	0.00	(102)
Gains												
0.00	0.00	0.00	0.00	0.00	1834.16	1757.35	1637.87	0.00	0.00	0.00	0.00	(103)

Space cooling requirement, whole dwelling, continuous (kWh) 0.024 x [(103)m - (102)m] x (41)m

0.00	0.00	0.00	0.00	0.00	315.34	403.12	333.38	0.00	0.00	0.00	0.00

∑(104)6...8 = 1051.84 (104)

Cooled fraction — cooled area ÷ (4) = 1.00 (105)

Intermittency factor (Table 10)

0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.00	0.00	0.00	0.00

∑(106)6...8 = 0.75 (106)

Space cooling requirement (104)m x (105) x (106)m

0.00	0.00	0.00	0.00	0.00	78.83	100.78	83.35	0.00	0.00	0.00	0.00

∑(107)6...8 = 262.96 (107)

Space cooling requirement kWh/m²/year — (107) ÷ (4) = 1.42 (108)

8f. Fabric energy efficiency

Dwelling Fabric Energy Efficiency (DFEE) — (99) + (108) = 49.59 (109)

SAP Worksheet
Design - Final

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Assessor name	Mr David Beard	Assessor number	3672
Client		Last modified	12/10/2015
Address	Plot 2 Heath House Lane, Hedge End, SO30 0LB		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		94.04	(1a)	x	2.40	(2a)	=	225.70	(3a)
+1		91.16	(1b)	x	2.60	(2b)	=	237.02	(3b)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	185.20	(4)						
Dwelling volume							(3a) + (3b) + (3c) + (3d)...(3n) =	462.71	(5)

2. Ventilation rate

			m³ per hour	
Number of chimneys	1	x 40 =	40	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent fans	6	x 10 =	60	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	100	÷ (5) =	0.22	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	5.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.47	(18)
Number of sides on which the dwelling is sheltered	1	(19)
Shelter factor	1 - [0.075 x (19)] = 0.93	(20)
Infiltration rate incorporating shelter factor	(18) x (20) = 0.43	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.55	0.54	0.53	0.47	0.46	0.41	0.41	0.40	0.43	0.46	0.49	0.51	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)

d) natural ventilation or whole house positive input ventilation from loft

	0.65	0.65	0.64	0.61	0.61	0.58	0.58	0.58	0.59	0.61	0.62	0.63	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.65	0.65	0.64	0.61	0.61	0.58	0.58	0.58	0.59	0.61	0.62	0.63	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²		U-value W/m²K		A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K	
Door			3.90	x	1.20	=	4.68			(26)
Window			33.11	x	1.33	=	43.90			(27)
Roof window			0.86	x	1.33	=	1.14			(27a)
Ground floor			94.04	x	0.13	=	12.23			(28a)
External wall			180.85	x	0.18	=	32.55			(29a)
Roof			99.24	x	0.13	=	12.90			(30)
Total area of external elements ∑A, m²			412.00							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	107.40 (33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m²K		100.00 (35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		26.29 (36)
Total fabric heat loss	(33) + (36) =	133.68 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)													
	99.42	98.52	97.65	93.52	92.75	89.16	89.16	88.49	90.54	92.75	94.31	95.94	(38)
Heat transfer coefficient, W/K (37)m + (38)m													
	233.10	232.20	231.33	227.20	226.43	222.84	222.84	222.17	224.22	226.43	227.99	229.62	
Average = ∑(39)1...12/12 =												227.20	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)													
	1.26	1.25	1.25	1.23	1.22	1.20	1.20	1.20	1.21	1.22	1.23	1.24	
Average = ∑(40)1...12/12 =												1.23	(40)
Number of days in month (Table 1a)													
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	2.98 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	105.04 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
	115.54	111.34	107.14	102.94	98.74	94.53	94.53	98.74	102.94	107.14	111.34	115.54	
∑(44)1...12 =												1260.45	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)													
	171.34	149.86	154.64	134.82	129.36	111.63	103.44	118.70	120.12	139.99	152.81	165.94	
∑(45)1...12 =												1652.65	(45)
Distribution loss 0.15 x (45)m													
	25.70	22.48	23.20	20.22	19.40	16.74	15.52	17.81	18.02	21.00	22.92	24.89	(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel	140.00 (47)
Water storage loss:	
b) Manufacturer's declared loss factor is not known	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.01 (51)
Volume factor from Table 2a	0.95 (52)
Temperature factor from Table 2b	0.54 (53)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	0.74 (54)
Enter (50) or (54) in (55)	0.74 (55)

Water storage loss calculated for each month (55) x (41)m

22.90	20.69	22.90	22.17	22.90	22.17	22.90	22.90	22.17	22.90	22.17	22.90	(56)

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)

22.90	20.69	22.90	22.17	22.90	22.17	22.90	22.90	22.17	22.90	22.17	22.90	(57)

Primary circuit loss for each month from Table 3

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

217.51	191.56	200.81	179.50	175.53	156.31	149.61	164.87	164.80	186.15	197.48	212.10	(62)

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

217.51	191.56	200.81	179.50	175.53	156.31	149.61	164.87	164.80	186.15	197.48	212.10	

∑(64)1...12 = 2196.22 (64)

Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

93.91	83.19	88.35	80.57	79.95	72.86	71.33	76.40	75.68	83.48	86.55	92.11	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	178.96	178.96	178.96	178.96	178.96	178.96	178.96	178.96	178.96	178.96	178.96	178.96	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	80.91	71.86	58.44	44.25	33.07	27.92	30.17	39.22	52.64	66.84	78.01	83.16	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	532.47	537.99	524.07	494.43	457.01	421.84	398.35	392.82	406.75	436.39	473.81	508.97	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.88	55.88	55.88	55.88	55.88	55.88	55.88	55.88	55.88	55.88	55.88	55.88	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	(71)
Water heating gains (Table 5)	126.22	123.79	118.75	111.90	107.45	101.19	95.87	102.69	105.11	112.20	120.21	123.80	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	858.12	852.18	819.79	769.10	716.07	669.49	642.92	653.26	683.03	733.96	790.55	834.46	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
South	0.77	x	15.76	x	46.75	x 0.9 x	0.63	x	0.70	=	225.18	(78)
North	0.77	x	11.19	x	10.63	x 0.9 x	0.63	x	0.70	=	36.36	(74)
West	0.77	x	1.18	x	19.64	x 0.9 x	0.63	x	0.70	=	7.08	(80)
East	0.77	x	1.18	x	19.64	x 0.9 x	0.63	x	0.70	=	7.08	(76)
NorthEast	0.77	x	1.90	x	11.28	x 0.9 x	0.63	x	0.70	=	6.55	(75)
NorthWest	0.77	x	1.90	x	11.28	x 0.9 x	0.63	x	0.70	=	6.55	(81)
East	1.00	x	0.86	x	26.61	x 0.9 x	0.63	x	0.70	=	9.08	(76)

Solar gains in watts ∑(74)m...(82)m

297.89	511.02	713.27	914.71	1058.12	1066.65	1021.53	911.12	782.00	568.15	357.35	254.64	(83)

Total gains - internal and solar (73)m + (83)m

1156.02	1363.20	1533.06	1683.82	1774.19	1736.14	1664.45	1564.39	1465.03	1302.10	1147.91	1089.10	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)												
0.96	0.95	0.92	0.86	0.77	0.64	0.51	0.55	0.74	0.88	0.95	0.97	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)												
18.42	18.72	19.18	19.78	20.31	20.71	20.88	20.85	20.56	19.87	19.05	18.38	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(˚C)												
19.87	19.88	19.88	19.90	19.90	19.92	19.92	19.92	19.91	19.90	19.90	19.89	(88)
Utilisation factor for gains for rest of dwelling n2,m												
0.96	0.94	0.90	0.84	0.73	0.57	0.41	0.45	0.67	0.86	0.94	0.96	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)												
16.44	16.88	17.54	18.40	19.13	19.65	19.84	19.82	19.47	18.54	17.37	16.39	(90)

Living area fraction — Living area ÷ (4) = 0.13 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

16.70	17.12	17.76	18.59	19.29	19.79	19.98	19.96	19.62	18.72	17.59	16.66	(92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

16.70	17.12	17.76	18.59	19.29	19.79	19.98	19.96	19.62	18.72	17.59	16.66	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm												
0.94	0.91	0.87	0.80	0.70	0.56	0.42	0.46	0.65	0.83	0.91	0.94	(94)
Useful gains, ηmGm, W (94)m x (84)m												
1080.91	1238.27	1332.28	1352.27	1248.95	976.28	694.56	714.70	958.06	1075.02	1045.12	1026.24	(95)
Monthly average external temperature from Table U1												
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]												
2891.48	2838.51	2605.61	2200.89	1718.40	1156.97	753.16	790.26	1237.42	1838.68	2392.15	2860.38	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m												
1347.06	1075.36	947.36	611.00	349.27	0.00	0.00	0.00	0.00	568.17	969.86	1364.60	

∑(98)1...5, 10...12 = 7232.67 (98)

Space heating requirement kWh/m²/year — (98) ÷ (4) = 39.05 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11) 0.10 (201)

Fraction of space heat from main system(s) — 1 - (201) = 0.90 (202)

Fraction of space heat from main system 2 0.00 (202)

Fraction of total space heat from main system 1 — (202) x [1- (203)] = 0.90 (204)

Fraction of total space heat from main system 2 — (202) x (203) = 0.00 (205)

Efficiency of main system 1 (%) 88.90 (206)

Efficiency of secondary/supplementary system (%) 65.00 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Space heating fuel (main system 1), kWh/month

1363.73	1088.66	959.08	618.56	353.59	0.00	0.00	0.00	0.00	575.20	981.86	1381.48

∑(211)1...5, 10...12 = 7322.17 (211)

Space heating fuel (secondary), kWh/month

207.24	165.44	145.75	94.00	53.73	0.00	0.00	0.00	0.00	87.41	149.21	209.94

∑(215)1...5, 10...12 = 1112.72 (215)

Water heating

Efficiency of water heater

87.20	87.06	86.78	86.18	85.00	78.80	78.80	78.80	78.80	85.96	86.85	87.25 (217)

Water heating fuel, kWh/month

249.44	220.04	231.40	208.28	206.51	198.36	189.86	209.22	209.13	216.56	227.39	243.09

∑(219a)1...12 = 2609.29 (219)

Annual totals

Space heating fuel - main system 1	7322.17	
Space heating fuel - secondary	1112.72	
Water heating fuel	2609.29	
Electricity for pumps, fans and electric keep-hot (Table 4f)		
central heating pump or water pump within warm air heating unit	30.00	(230c)
boiler flue fan	45.00	(230e)
Total electricity for the above, kWh/year	75.00	(231)
Electricity for lighting (Appendix L)	571.55	(232)
Energy saving/generation technologies		
electricity generated by PV (Appendix M)	-1424.97	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =	10265.76	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	7322.17	x	3.48	x 0.01 =	254.81	(240)
Space heating - secondary	1112.72	x	4.23	x 0.01 =	47.07	(242)
Water heating	2609.29	x	3.48	x 0.01 =	90.80	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	571.55	x	13.19	x 0.01 =	75.39	(250)
Additional standing charges					120.00	(251)
Energy saving/generation technologies						
pv savings	-1424.97	x	13.19	x 0.01 =	-187.95	(252)
Total energy cost			(240)...(242) + (245)...(254) =		410.01	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	0.75	(257)
SAP value	89.56	
SAP rating (section 13)	90	(258)
SAP band	B	

12a. CO_2 emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating - main system 1	7322.17	x	0.22	=	1581.59	(261)
Space heating - secondary	1112.72	x	0.02	=	21.14	(263)

Water heating	2609.29	x	0.22	=	563.61	(264)
Space and water heating			(261) + (262) + (263) + (264) =		2166.34	(265)
Pumps and fans	75.00	x	0.52	=	38.93	(267)
Electricity for lighting	571.55	x	0.52	=	296.64	(268)
Energy saving/generation technologies						
pv savings	-1424.97	x	0.52	=	-739.56	(269)
Total CO_2, kg/year				(265)...(271) =	1762.34	(272)
Dwelling CO_2 emission rate				(272) ÷ (4) =	9.52	(273)
EI value					89.74	
EI rating (section 14)					90	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	7322.17	x	1.22	=	8933.05	(261)
Space heating - secondary	1112.72	x	1.04	=	1157.23	(263)
Water heating	2609.29	x	1.22	=	3183.33	(264)
Space and water heating			(261) + (262) + (263) + (264) =		13273.60	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	571.55	x	3.07	=	1754.67	(268)
Energy saving/generation technologies						
Electricity generated - PVs	-1424.97	x	3.07	=	-4374.67	(269)
Primary energy kWh/year					10883.86	(272)
Dwelling primary energy rate kWh/m2/year					58.77	(273)

TER Worksheet
Design - Final

This design submission has been carried out by an On-Construction Domestic Energy Assessor. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr David Beard	Assessor number	3672
Client		Last modified	12/10/2015
Address	Plot 2 Heath House Lane, Hedge End, SO30 0LB		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		94.04	(1a)	x	2.40	(2a)	=	225.70	(3a)
+1		91.16	(1b)	x	2.60	(2b)	=	237.02	(3b)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	185.20	(4)						
Dwelling volume						(3a) + (3b) + (3c) + (3d)...(3n) =		462.71	(5)

2. Ventilation rate

				m³ per hour	
Number of chimneys		0	x 40 =	0	(6a)
Number of open flues		0	x 20 =	0	(6b)
Number of intermittent fans		4	x 10 =	40	(7a)
Number of passive vents		0	x 10 =	0	(7b)
Number of flueless gas fires		0	x 40 =	0	(7c)
				Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	40	÷ (5) =	0.09	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.34	(18)
Number of sides on which the dwelling is sheltered		1	(19)
Shelter factor	1 - [0.075 x (19)] =	0.93	(20)
Infiltration rate incorporating shelter factor	(18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.40	0.39	0.38	0.34	0.33	0.30	0.30	0.29	0.31	0.33	0.35	0.37	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)

d) natural ventilation or whole house positive input ventilation from loft

0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57

(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²		U-value W/m²K		A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K	
Door			3.90	x	1.20	=	4.68			(26)
Window			33.11	x	1.33	=	43.90			(27)
Roof window			0.86	x	1.59	=	1.37			(27a)
Ground floor			94.04	x	0.13	=	12.23			(28a)
External wall			180.85	x	0.18	=	32.55			(29a)
Roof			99.24	x	0.13	=	12.90			(30)
Total area of external elements ∑A, m²			412.00							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	107.62 (33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m²K		250.00 (35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		18.74 (36)
Total fabric heat loss	(33) + (36) =	126.36 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)													
	88.37	87.90	87.44	85.29	84.89	83.02	83.02	82.67	83.74	84.89	85.71	86.56	(38)
Heat transfer coefficient, W/K (37)m + (38)m													
	214.73	214.27	213.81	211.66	211.26	209.39	209.39	209.04	210.11	211.26	212.07	212.92	
Average = ∑(39)1...12/12 =												211.66	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)													
	1.16	1.16	1.15	1.14	1.14	1.13	1.13	1.13	1.13	1.14	1.15	1.15	
Average = ∑(40)1...12/12 =												1.14	(40)
Number of days in month (Table 1a)													
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	2.98 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	105.04 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
	115.54	111.34	107.14	102.94	98.74	94.53	94.53	98.74	102.94	107.14	111.34	115.54	
∑(44)1...12 =												1260.45	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)													
	171.34	149.86	154.64	134.82	129.36	111.63	103.44	118.70	120.12	139.99	152.81	165.94	
∑(45)1...12 =												1652.65	(45)
Distribution loss 0.15 x (45)m													
	25.70	22.48	23.20	20.22	19.40	16.74	15.52	17.81	18.02	21.00	22.92	24.89	(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel	140.00 (47)
Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day)	1.34 (48)
Temperature factor from Table 2b	0.54 (49)
Energy lost from water storage (kWh/day) (48) x (49)	0.72 (50)
Enter (50) or (54) in (55)	0.72 (55)

Water storage loss calculated for each month (55) x (41)m

22.41	20.24	22.41	21.69	22.41	21.69	22.41	22.41	21.69	22.41	21.69	22.41	(56)

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)

22.41	20.24	22.41	21.69	22.41	21.69	22.41	22.41	21.69	22.41	21.69	22.41	(57)

Primary circuit loss for each month from Table 3

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

217.02	191.11	200.31	179.02	175.04	155.83	149.12	164.37	164.32	185.66	197.01	211.61	(62)

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

217.02	191.11	200.31	179.02	175.04	155.83	149.12	164.37	164.32	185.66	197.01	211.61	

∑(64)1...12 = 2190.42 (64)

Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

93.51	82.83	87.96	80.19	79.55	72.48	70.93	76.01	75.30	83.08	86.17	91.71	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.36	28.75	23.38	17.70	13.23	11.17	12.07	15.69	21.05	26.73	31.20	33.26	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	356.75	360.45	351.13	331.27	306.20	282.63	266.89	263.19	272.52	292.38	317.45	341.01	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	(71)
Water heating gains (Table 5)	125.69	123.26	118.22	111.37	106.93	100.66	95.34	102.16	104.58	111.67	119.68	123.27	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	585.54	583.20	563.46	531.08	497.09	465.21	445.04	451.78	468.90	501.53	539.07	568.29	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
South	0.77	x	15.76	x	46.75	x 0.9 x	0.63	x	0.70	=	225.18	(78)
North	0.77	x	11.19	x	10.63	x 0.9 x	0.63	x	0.70	=	36.36	(74)
West	0.77	x	1.18	x	19.64	x 0.9 x	0.63	x	0.70	=	7.08	(80)
East	0.77	x	1.18	x	19.64	x 0.9 x	0.63	x	0.70	=	7.08	(76)
NorthEast	0.77	x	1.90	x	11.28	x 0.9 x	0.63	x	0.70	=	6.55	(75)
NorthWest	0.77	x	1.90	x	11.28	x 0.9 x	0.63	x	0.70	=	6.55	(81)
East	1.00	x	0.86	x	26.61	x 0.9 x	0.63	x	0.70	=	9.08	(76)

Solar gains in watts ∑(74)m...(82)m

297.89	511.02	713.27	914.71	1058.12	1066.65	1021.53	911.12	782.00	568.15	357.35	254.64	(83)

Total gains - internal and solar (73)m + (83)m

883.44	1094.22	1276.74	1445.79	1555.21	1531.86	1466.57	1362.90	1250.90	1069.67	896.43	822.93

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	1.00	0.99	0.97	0.92	0.78	0.60	0.67	0.89	0.99	1.00	1.00

(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.63	19.81	20.07	20.42	20.73	20.92	20.98	20.97	20.83	20.42	19.96	19.60

(87)

Temperature during heating periods in the rest of dwelling from Table 9, Th2(˚C)

19.95	19.95	19.96	19.97	19.97	19.98	19.98	19.98	19.97	19.97	19.96	19.96

(88)

Utilisation factor for gains for rest of dwelling n2,m

1.00	1.00	0.99	0.96	0.88	0.69	0.48	0.54	0.83	0.98	1.00	1.00

(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.11	18.37	18.76	19.26	19.69	19.92	19.97	19.97	19.83	19.27	18.60	18.08

(90)

Living area fraction — Living area ÷ (4) = 0.13 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.32	18.56	18.94	19.42	19.82	20.06	20.10	20.10	19.96	19.43	18.78	18.28

(92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.32	18.56	18.94	19.42	19.82	20.06	20.10	20.10	19.96	19.43	18.78	18.28

(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, ηm

1.00	1.00	0.99	0.96	0.87	0.69	0.49	0.55	0.83	0.97	1.00	1.00

(94)

Useful gains, ηmGm, W (94)m x (84)m

882.07	1089.22	1259.71	1383.92	1358.06	1064.04	722.93	754.27	1036.90	1041.29	893.02	822.03

(95)

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20

(96)

Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

3010.08	2927.52	2658.78	2225.74	1716.43	1142.25	733.86	773.46	1231.42	1864.93	2477.50	2998.50

(97)

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

1583.24	1235.34	1040.91	606.11	266.63	0.00	0.00	0.00	0.00	612.79	1140.83	1619.30

∑(98)1...5, 10...12 = 8105.14 (98)

Space heating requirement kWh/m²/year — (98) ÷ (4) = 43.76 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11) 0.00 (201)

Fraction of space heat from main system(s) — 1 - (201) = 1.00 (202)

Fraction of space heat from main system 2 0.00 (202)

Fraction of total space heat from main system 1 — (202) x [1- (203)] = 1.00 (204)

Fraction of total space heat from main system 2 — (202) x (203) = 0.00 (205)

Efficiency of main system 1 (%) 93.50 (206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Space heating fuel (main system 1), kWh/month

1693.31	1321.22	1113.27	648.25	285.17	0.00	0.00	0.00	0.00	655.39	1220.14	1731.87

∑(211)1...5, 10...12 = 8668.60 (211)

Water heating

Efficiency of water heater

89.06	88.90	88.58	87.82	85.93	79.80	79.80	79.80	79.80	87.76	88.75	89.12

(217)

Water heating fuel, kWh/month

243.68	214.97	226.13	203.86	203.69	195.28	186.86	205.98	205.91	211.55	221.99	237.45

∑(219a)1...12 = 2557.34 (219)

Annual totals

Space heating fuel - main system 1	8668.60	
Water heating fuel	2557.34	
Electricity for pumps, fans and electric keep-hot (Table 4f)		
central heating pump or water pump within warm air heating unit	30.00	(230c)
boiler flue fan	45.00	(230e)
Total electricity for the above, kWh/year	75.00	(231)
Electricity for lighting (Appendix L)	571.55	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =	11872.50	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	8668.60	x	3.48	x 0.01 =	301.67	(240)
Water heating	2557.34	x	3.48	x 0.01 =	89.00	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	571.55	x	13.19	x 0.01 =	75.39	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)...(242) + (245)...(254) =		595.94	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.09	(257)
SAP value	84.83	
SAP rating (section 13)	85	(258)
SAP band	B	

12a. CO_2 emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating - main system 1	8668.60	x	0.22	=	1872.42	(261)
Water heating	2557.34	x	0.22	=	552.39	(264)
Space and water heating			(261) + (262) + (263) + (264) =		2424.80	(265)
Pumps and fans	75.00	x	0.52	=	38.93	(267)
Electricity for lighting	571.55	x	0.52	=	296.64	(268)
Total CO_2, kg/year				(265)...(271) =	2760.37	(272)
Dwelling CO_2 emission rate				(272) ÷ (4) =	14.90	(273)
EI value					83.93	
EI rating (section 14)					84	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	8668.60	x	1.22	=	10575.70	(261)

Water heating	2557.34	x	1.22	=	3119.95	(264)
Space and water heating			(261) + (262) + (263) + (264) =		13695.65	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	571.55	x	3.07	=	1754.67	(268)
Primary energy kWh/year					15680.57	(272)
Dwelling primary energy rate kWh/m2/year					84.67	(273)

TFEE Worksheet
Design - Final

This design submission has been carried out by an On-Construction Domestic Energy Assessor. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr David Beard	Assessor number	3672
Client		Last modified	12/10/2015
Address	Plot 2 Heath House Lane, Hedge End, SO30 0LB		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		94.04	(1a)	x	2.40	(2a)	=	225.70	(3a)
+1		91.16	(1b)	x	2.60	(2b)	=	237.02	(3b)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	185.20	(4)						
Dwelling volume						(3a) + (3b) + (3c) + (3d)...(3n) =		462.71	(5)

2. Ventilation rate

			m³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent fans	4	x 10 =	40	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	40	÷ (5) =	0.09 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	5.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.34	(18)
Number of sides on which the dwelling is sheltered	1	(19)
Shelter factor	1 - [0.075 x (19)] = 0.93	(20)
Infiltration rate incorporating shelter factor	(18) x (20) = 0.31	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.40	0.39	0.38	0.34	0.33	0.30	0.30	0.29	0.31	0.33	0.35	0.37	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)

d) natural ventilation or whole house positive input ventilation from loft

	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57

(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²		U-value W/m²K		A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K	
Door			3.90	x	1.20	=	4.68			(26)
Window			33.11	x	1.33	=	43.90			(27)
Roof window			0.86	x	1.59	=	1.37			(27a)
Ground floor			94.04	x	0.13	=	12.23			(28a)
External wall			180.85	x	0.18	=	32.55			(29a)
Roof			99.24	x	0.13	=	12.90			(30)
Total area of external elements ∑A, m²			412.00							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	107.62 (33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m²K		250.00 (35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		18.74 (36)
Total fabric heat loss	(33) + (36) =	126.36 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)													
	88.37	87.90	87.44	85.29	84.89	83.02	83.02	82.67	83.74	84.89	85.71	86.56	(38)
Heat transfer coefficient, W/K (37)m + (38)m													
	214.73	214.27	213.81	211.66	211.26	209.39	209.39	209.04	210.11	211.26	212.07	212.92	
Average = ∑(39)1...12/12 =												211.66	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)													
	1.16	1.16	1.15	1.14	1.14	1.13	1.13	1.13	1.13	1.14	1.15	1.15	
Average = ∑(40)1...12/12 =												1.14	(40)
Number of days in month (Table 1a)													
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	2.98 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	105.04 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
	115.54	111.34	107.14	102.94	98.74	94.53	94.53	98.74	102.94	107.14	111.34	115.54	
∑(44)1...12 =												1260.45	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)													
	171.34	149.86	154.64	134.82	129.36	111.63	103.44	118.70	120.12	139.99	152.81	165.94	
∑(45)1...12 =												1652.65	(45)
Distribution loss 0.15 x (45)m													
	25.70	22.48	23.20	20.22	19.40	16.74	15.52	17.81	18.02	21.00	22.92	24.89	(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel	140.00 (47)
Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day)	1.34 (48)
Temperature factor from Table 2b	0.54 (49)
Energy lost from water storage (kWh/day) (48) x (49)	0.72 (50)
Enter (50) or (54) in (55)	0.72 (55)

Water storage loss calculated for each month (55) x (41)m

22.41	20.24	22.41	21.69	22.41	21.69	22.41	22.41	21.69	22.41	21.69	22.41	(56)

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)

22.41	20.24	22.41	21.69	22.41	21.69	22.41	22.41	21.69	22.41	21.69	22.41	(57)

Primary circuit loss for each month from Table 3

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

217.02	191.11	200.31	179.02	175.04	155.83	149.12	164.37	164.32	185.66	197.01	211.61	(62)

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

171.34	149.86	154.64	134.82	129.36	111.63	103.44	118.70	120.12	139.99	152.81	165.94	

∑(64)1...12 = 1652.65 (64)

Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

36.41	31.84	32.86	28.65	27.49	23.72	21.98	25.22	25.53	29.75	32.47	35.26	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	149.13	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.36	28.75	23.38	17.70	13.23	11.17	12.07	15.69	21.05	26.73	31.20	33.26	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	356.75	360.45	351.13	331.27	306.20	282.63	266.89	263.19	272.52	292.38	317.45	341.01	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	37.91	(69)
Pump and fan gains (Table 5a)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evaporation (Table 5)	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	-119.31	(71)
Water heating gains (Table 5)	48.94	47.39	44.17	39.79	36.95	32.95	29.54	33.90	35.45	39.98	45.10	47.39	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	505.79	504.33	486.41	456.49	424.11	394.49	376.25	380.52	396.77	426.84	461.49	489.41	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
South	0.77	x	15.76	x	46.75	x 0.9 x	0.63	x	0.70	=	225.18	(78)
North	0.77	x	11.19	x	10.63	x 0.9 x	0.63	x	0.70	=	36.36	(74)
West	0.77	x	1.18	x	19.64	x 0.9 x	0.63	x	0.70	=	7.08	(80)
East	0.77	x	1.18	x	19.64	x 0.9 x	0.63	x	0.70	=	7.08	(76)
NorthEast	0.77	x	1.90	x	11.28	x 0.9 x	0.63	x	0.70	=	6.55	(75)
NorthWest	0.77	x	1.90	x	11.28	x 0.9 x	0.63	x	0.70	=	6.55	(81)
East	1.00	x	0.86	x	26.61	x 0.9 x	0.63	x	0.70	=	9.08	(76)

Solar gains in watts ∑(74)m...(82)m

297.89	511.02	713.27	914.71	1058.12	1066.65	1021.53	911.12	782.00	568.15	357.35	254.64	(83)

Total gains - internal and solar (73)m + (83)m

803.69	1015.35	1199.68	1371.21	1482.23	1461.14	1397.77	1291.65	1178.77	994.98	818.85	744.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)	1.00	1.00	0.99	0.98	0.93	0.80	0.63	0.69	0.91	0.99	1.00	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)	19.59	19.77	20.03	20.38	20.70	20.91	20.98	20.97	20.81	20.38	19.92	19.56	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(˚C)	19.95	19.95	19.96	19.97	19.97	19.98	19.98	19.98	19.97	19.97	19.96	19.96	(88)
Utilisation factor for gains for rest of dwelling n2,m	1.00	1.00	0.99	0.97	0.90	0.71	0.50	0.56	0.85	0.98	1.00	1.00	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)	18.66	18.83	19.10	19.45	19.75	19.93	19.97	19.97	19.86	19.46	18.99	18.64	(90)

Living area fraction — Living area ÷ (4) = 0.13 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2	18.78	18.96	19.23	19.58	19.88	20.06	20.11	20.10	19.98	19.58	19.12	18.76	(92)
Apply adjustment to the mean internal temperature from Table 4e where appropriate	18.78	18.96	19.23	19.58	19.88	20.06	20.11	20.10	19.98	19.58	19.12	18.76	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm	1.00	1.00	0.99	0.97	0.89	0.72	0.52	0.58	0.85	0.98	1.00	1.00	(94)
Useful gains, ηmGm, W (94)m x (84)m	803.00	1012.42	1188.52	1325.77	1322.03	1051.83	720.61	749.90	1007.62	976.56	817.03	743.62	(95)
Monthly average external temperature from Table U1	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]	3109.88	3012.32	2721.10	2259.91	1728.33	1143.91	733.96	773.64	1236.34	1897.87	2548.69	3100.11	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m	1716.32	1343.93	1140.24	672.58	302.29	0.00	0.00	0.00	0.00	685.45	1246.79	1753.23	

∑(98)1...5, 10...12 = 8860.83 (98)

Space heating requirement kWh/m²/year — (98) ÷ (4) = 47.84 (99)

8c. Space cooling requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm	0.00	0.00	0.00	0.00	0.00	1968.22	1549.45	1588.69	0.00	0.00	0.00	0.00	(100)
Utilisation factor for loss ηm	0.00	0.00	0.00	0.00	0.00	0.81	0.88	0.85	0.00	0.00	0.00	0.00	(101)
Useful loss ηmLm (watts) (100)m x (101)m	0.00	0.00	0.00	0.00	0.00	1584.60	1369.32	1348.14	0.00	0.00	0.00	0.00	(102)
Gains	0.00	0.00	0.00	0.00	0.00	1834.16	1757.35	1637.87	0.00	0.00	0.00	0.00	(103)
Space cooling requirement, whole dwelling, continuous (kWh) 0.024 x [(103)m - (102)m] x (41)m	0.00	0.00	0.00	0.00	0.00	179.69	288.70	215.56	0.00	0.00	0.00	0.00	

∑(104)6...8 = 683.94 (104)

Cooled fraction — cooled area ÷ (4) = 1.00 (105)

Intermittency factor (Table 10)

0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.00	0.00	0.00	0.00

∑(106)6...8 = 0.75 (106)

Space cooling requirement (104)m x (105) x (106)m

0.00	0.00	0.00	0.00	0.00	44.92	72.18	53.89	0.00	0.00	0.00	0.00

∑(107)6...8 = 170.99 (107)

Space cooling requirement kWh/m²/year — (107) ÷ (4) = 0.92 (108)

8f. Fabric energy efficiency

Target Fabric Energy Efficiency (TFEE) — [(99) + (108)] * 1.15 = 56.08 (109)

Predicted Energy Assessment

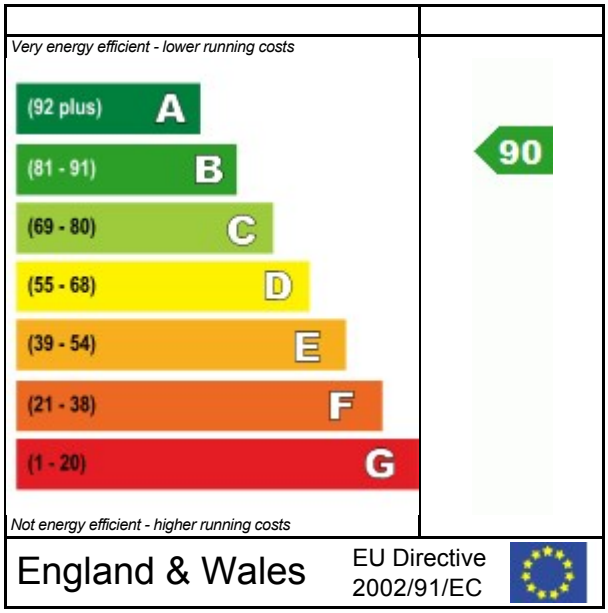
Plot 2
Heath House Lane
Hedge End
SO30 0LB

Dwelling type: Detached house
Date of assessment: 27-Apr-2015
Produced by: Mr David Beard
Total floor area: 185 m²

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

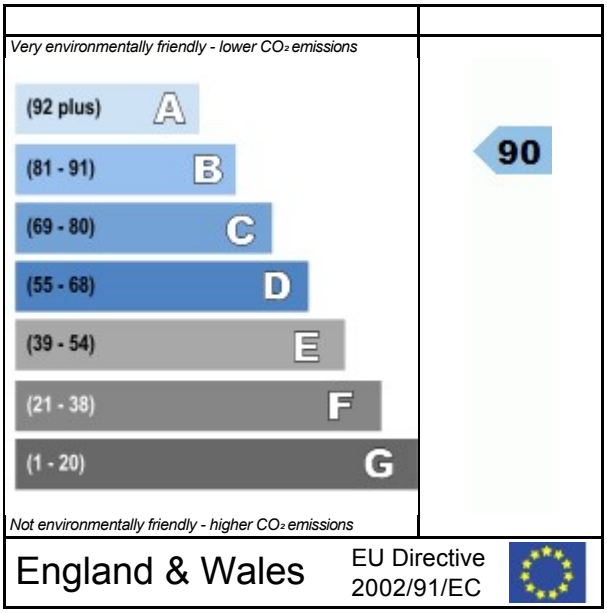
Energy performance has been assessed using the SAP 2009 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO_2) Rating



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

Predicted Energy Assessment