

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

212.66	187.40	196.73	176.23	172.62	154.12	147.90	162.45	162.21	182.75	193.39	207.50	(62)
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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)
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Output from water heater for each month (kWh/month) (62)m + (63)m

212.66	187.40	196.73	176.23	172.62	154.12	147.90	162.45	162.21	182.75	193.39	207.50	
$\Sigma(64)1...12 =$											2155.94	(64)

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

93.73	83.10	88.43	80.88	80.42	73.52	72.20	77.04	76.21	83.79	86.58	92.01	(65)
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5. Internal gains

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

Metabolic gains (Table 5)

138.90	138.90	138.90	138.90	138.90	138.90	138.90	138.90	138.90	138.90	138.90	138.90	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

23.49	20.86	16.97	12.85	9.60	8.11	8.76	11.39	15.28	19.40	22.65	24.14	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

263.50	266.23	259.34	244.67	226.15	208.75	197.13	194.39	201.28	215.95	234.47	251.87	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.89	36.89	36.89	36.89	36.89	36.89	36.89	36.89	36.89	36.89	36.89	36.89	(69)
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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)
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Losses e.g. evaporation (Table 5)

-111.12	-111.12	-111.12	-111.12	-111.12	-111.12	-111.12	-111.12	-111.12	-111.12	-111.12	-111.12	(71)
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Water heating gains (Table 5)

125.98	123.67	118.86	112.33	108.09	102.11	97.04	103.54	105.85	112.61	120.25	123.68	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

480.64	478.43	462.84	437.51	411.51	386.64	370.59	376.99	390.09	415.64	445.03	467.36	(73)
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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

West $0.77 \times 11.76 \times 19.64 \times 0.9 \times 0.63 \times 0.70 = 70.59$ (80)

North $0.77 \times 13.14 \times 10.63 \times 0.9 \times 0.63 \times 0.70 = 42.70$ (74)

Solar gains in watts $\Sigma(74)m...(82)m$

113.29	219.69	366.07	554.39	706.50	737.28	696.01	578.18	431.20	260.99	140.69	93.65	(83)
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Total gains - internal and solar (73)m + (83)m

593.92	698.12	828.91	991.90	1118.01	1123.92	1066.60	955.17	821.29	676.63	585.72	561.00	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00	(85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	1.00	0.98	0.91	0.73	0.52	0.38	0.44	0.73	0.96	1.00	1.00	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

20.07	20.22	20.48	20.79	20.96	21.00	21.00	21.00	20.97	20.71	20.33	20.04	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.16	20.16	20.17	20.18	20.18	20.19	20.19	20.19	20.19	20.18	20.17	20.17	(88)
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Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.98	0.88	0.68	0.45	0.31	0.36	0.66	0.95	0.99	1.00	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.90	19.13	19.50	19.94	20.14	20.19	20.19	20.19	20.16	19.84	19.30	18.88	(90)
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Living area fraction

Living area ÷ (4) = 0.47 (91)

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

19.45	19.64	19.96	20.34	20.52	20.57	20.57	20.57	20.54	20.25	19.78	19.42	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.45	19.64	19.96	20.34	20.52	20.57	20.57	20.57	20.54	20.25	19.78	19.42	(93)
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8. Space heating requirement

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

Utilisation factor for gains, ηm

1.00	0.99	0.97	0.89	0.70	0.48	0.34	0.40	0.69	0.95	0.99	1.00	(94)
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Useful gains, ηmGm, W (94)m x (84)m

592.34	693.02	806.81	881.95	782.34	541.89	362.18	379.09	568.10	643.03	581.88	559.92	(95)
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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)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1439.45	1395.94	1270.41	1062.69	817.20	544.84	362.45	379.76	591.34	893.47	1181.64	1427.65	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

630.25	472.36	344.92	130.13	25.94	0.00	0.00	0.00	0.00	186.33	431.83	645.59	
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Σ(98)1...5, 10...12 = 2867.35 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 27.42 (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

674.07	505.20	368.90	139.18	27.74	0.00	0.00	0.00	0.00	199.28	461.85	690.47	
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Σ(211)1...5, 10...12 = 3066.69 (211)

Water heating

Efficiency of water heater

87.54	87.18	86.30	84.02	81.05	79.80	79.80	79.80	79.80	84.87	86.90	87.64	(217)
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Water heating fuel, kWh/month

242.93	214.96	227.96	209.75	212.97	193.13	185.33	203.57	203.27	215.34	222.55	236.76	
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Σ(219a)1...12 = 2568.53 (219)

Annual totals

Space heating fuel - main system 1

3066.69

Water heating fuel

2568.53

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)

414.86 (232)

Total delivered energy for all uses

(211)...(221) + (231) + (232)...(237b) = 6125.07 (238)

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

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3066.69	x	3.48	x 0.01 =	106.72	(240)
Water heating	2568.53	x	3.48	x 0.01 =	89.38	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	414.86	x	13.19	x 0.01 =	54.72	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	380.72	(255)

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

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.07	(257)
SAP value	85.09	
SAP rating (section 13)	85	(258)
SAP band	B	

12a. CO₂ 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	3066.69	x	0.216	=	662.40	(261)
Water heating	2568.53	x	0.216	=	554.80	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1217.21	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	414.86	x	0.519	=	215.31	(268)
Total CO ₂ , kg/year			(265)...(271) =		1471.44	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		14.07	(273)
EI value					86.82	
EI rating (section 14)					87	(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	3066.69	x	1.22	=	3741.36	(261)
Water heating	2568.53	x	1.22	=	3133.61	(264)
Space and water heating			(261) + (262) + (263) + (264) =		6874.96	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	414.86	x	3.07	=	1273.61	(268)
Primary energy kWh/year					8378.82	(272)
Dwelling primary energy rate kWh/m ² /year					80.13	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr AECOM Planner	Assessor number	101
Client	Default Client	Last modified	30/08/2018
Address	2.5 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	97.18 (1a) x	2.62 (2a) =	254.61 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 97.18 (4)		
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) = 254.61 (5)		

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (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) = 0 ÷ (5) = 0.00 (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	3.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
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Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.13 (21)
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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

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
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	76.50 (23c)
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a) If balanced mechanical ventilation with heat recovery (MVHR) (22b)m + (23b) x [1 - (23c) ÷ 100]

0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.25	0.26	0.27
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.25	0.25	0.26	0.27
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Window			22.74	1.33	30.15		(27)						
External wall			35.02	0.18	6.30		(29a)						
Party wall			57.76	0.00	0.00		(32)						
Total area of external elements ΣA, m ²			57.76				(31)						
Fabric heat loss, W/K = Σ(A × U)					(26)...(30) + (32) =	36.45	(33)						
Heat capacity Cm = Σ(A × κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						100.00	(35)						
Thermal bridges: Σ(L × Ψ) calculated using Appendix K						8.66	(36)						
Total fabric heat loss					(33) + (36) =	45.12	(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)	23.53	23.26	23.00	21.66	21.39	20.05	20.05	19.78	20.59	21.39	21.92	22.46	(38)
Heat transfer coefficient, W/K (37)m + (38)m	68.65	68.38	68.11	66.77	66.50	65.17	65.17	64.90	65.70	66.50	67.04	67.58	
	Average = Σ(39)1...12/12 =											66.70	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.71	0.70	0.70	0.69	0.68	0.67	0.67	0.67	0.68	0.68	0.69	0.70	
	Average = Σ(40)1...12/12 =											0.69	(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												2.71	(42)	
Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$												98.61	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$	108.47	104.52	100.58	96.63	92.69	88.75	88.75	92.69	96.63	100.58	104.52	108.47		
												$\Sigma(44)_{1...12} =$	1183.27	(44)
Energy content of hot water used = $4.18 \times V_{d,m} \times n_m \times T_m / 3600$ kWh/month (see Tables 1b, 1c 1d)	160.85	140.68	145.17	126.56	121.44	104.80	97.11	111.43	112.76	131.42	143.45	155.78		
												$\Sigma(45)_{1...12} =$	1551.46	(45)
Distribution loss $0.15 \times (45)m$	24.13	21.10	21.78	18.98	18.22	15.72	14.57	16.71	16.91	19.71	21.52	23.37	(46)	
Storage volume (litres) including any solar or WWHRS storage within same vessel												180.00	(47)	
Water storage loss:														
a) If manufacturer's declared loss factor is known (kWh/day)												1.85	(48)	
Temperature factor from Table 2b												0.60	(49)	
Energy lost from water storage (kWh/day) $(48) \times (49)$												1.11	(50)	
Enter (50) or (54) in (55)												1.11	(55)	
Water storage loss calculated for each month $(55) \times (41)m$	34.41	31.08	34.41	33.30	34.41	33.30	34.41	34.41	33.30	34.41	33.30	34.41	(56)	
If the vessel contains dedicated solar storage or dedicated WWHRS $(56)m \times [(47) - V_s] \div (47)$, else (56)	34.41	31.08	34.41	33.30	34.41	33.30	34.41	34.41	33.30	34.41	33.30	34.41	(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)
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Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

218.53	192.77	202.84	182.38	179.11	160.61	154.78	169.11	168.58	189.09	199.26	213.45	(62)
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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)
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Output from water heater for each month (kWh/month) (62)m + (63)m

218.53	192.77	202.84	182.38	179.11	160.61	154.78	169.11	168.58	189.09	199.26	213.45	
$\Sigma(64)1...12 =$											2230.51	(64)

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

99.62	88.45	94.41	86.73	86.52	79.49	78.43	83.19	82.14	89.83	92.35	97.93	(65)
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5. Internal gains

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

Metabolic gains (Table 5)

135.59	135.59	135.59	135.59	135.59	135.59	135.59	135.59	135.59	135.59	135.59	135.59	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

22.44	19.93	16.21	12.27	9.17	7.74	8.37	10.88	14.60	18.53	21.63	23.06	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

251.69	254.30	247.72	233.71	216.02	199.40	188.29	185.68	192.26	206.27	223.96	240.58	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.56	36.56	36.56	36.56	36.56	36.56	36.56	36.56	36.56	36.56	36.56	36.56	(69)
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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)

-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	(71)
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Water heating gains (Table 5)

133.90	131.62	126.89	120.46	116.29	110.41	105.41	111.81	114.09	120.74	128.26	131.63	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

471.70	469.53	454.49	430.12	405.16	381.23	365.75	372.05	384.62	409.23	437.53	458.95	(73)
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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

North $0.77 \times 10.26 \times 10.63 \times 0.9 \times 0.45 \times 0.80 = 27.22$ (74)

East $0.77 \times 12.48 \times 19.64 \times 0.9 \times 0.45 \times 0.80 = 61.15$ (76)

Solar gains in watts $\Sigma(74)m...(82)m$

88.37	171.64	285.39	429.29	543.36	565.19	534.31	446.43	335.39	203.86	109.82	72.98	(83)
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Total gains - internal and solar (73)m + (83)m

560.07	641.16	739.88	859.40	948.52	946.41	900.06	818.47	720.01	613.09	547.35	531.93	(84)
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7. Mean internal temperature (heating season)

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

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 21.00 (85)

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

0.96	0.94	0.88	0.76	0.60	0.43	0.32	0.36	0.58	0.83	0.94	0.97	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

19.68	19.91	20.27	20.66	20.89	20.98	20.99	20.99	20.93	20.60	20.08	19.64	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.34	20.34	20.34	20.35	20.35	20.37	20.37	20.37	20.36	20.35	20.35	20.34
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 (88)

Utilisation factor for gains for rest of dwelling n2,m

0.96	0.93	0.87	0.74	0.57	0.39	0.27	0.31	0.54	0.81	0.93	0.96
------	------	------	------	------	------	------	------	------	------	------	------

 (89)

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

18.54	18.87	19.38	19.94	20.23	20.34	20.36	20.36	20.29	19.86	19.13	18.49
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 (90)

Living area fraction

Living area ÷ (4) = 0.42 (91)

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

19.02	19.31	19.76	20.25	20.51	20.61	20.63	20.63	20.56	20.18	19.54	18.98
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 (92)

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

19.02	19.31	19.76	20.25	20.51	20.61	20.63	20.63	20.56	20.18	19.54	18.98
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 (93)

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.94	0.92	0.86	0.73	0.57	0.41	0.29	0.33	0.55	0.80	0.92	0.95
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 (94)

Useful gains, ηmGm, W (94)m x (84)m

528.56	586.72	632.70	631.52	543.92	383.34	260.84	271.47	398.04	491.87	501.00	505.82
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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
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 (96)

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

1010.52	985.55	903.08	757.57	585.81	391.79	262.66	274.44	424.30	636.96	833.68	998.87
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 (97)

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

358.58	268.02	201.16	90.75	31.17	0.00	0.00	0.00	0.00	107.95	239.52	366.83
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Σ(98)1...5, 10...12 = 1663.98 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 17.12 (99)

9b. Energy requirements - community heating scheme

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

'0' if none 0.00 (301)

Fraction of space heat from community system

1 - (301) = 1.00 (302)

Fraction of community heat from boilers

1.00 (303a)

Fraction of total space heat from community boilers

(302) x (303a) = 1.00 (304a)

Factor for control and charging method (Table 4c(3)) for community space heating

1.00 (305)

Factor for charging method (Table 4c(3)) for community water heating

1.00 (305a)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

1663.98 (98)

Space heat from boilers

(98) x (304a) x (305) x (306) = 1747.18 (307a)

Water heating

Annual water heating requirement

2230.51 (64)

Water heat from boilers

(64) x (303a) x (305a) x (306) = 2342.03 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 40.89 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside

213.56 (330a)

Total electricity for the above, kWh/year

213.56 (331)

Electricity for lighting (Appendix L)									396.26	(332)
Total delivered energy for all uses									(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =	4699.03 (338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1747.18	x	4.24	x 0.01 =	74.08	(340a)
Water heating from boilers	2342.03	x	4.24	x 0.01 =	99.30	(342a)
Pumps and fans	213.56	x	13.19	x 0.01 =	28.17	(349)
Electricity for lighting	396.26	x	13.19	x 0.01 =	52.27	(350)
Additional standing charges					120.00	(351)
Total energy cost				(340a)...(342e) + (345)...(354) =	373.82	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)		0.42	(356)
Energy cost factor (ECF)		1.10	(357)
SAP value		84.60	
SAP rating (section 13)		85	(358)
SAP band		B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	89.50					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	4568.95	x	0.216	=	986.89 (367)
Electrical energy for community heat distribution	40.89	x	0.519	=	21.22	(372)
Total CO ₂ associated with community systems					1008.12	(373)
Total CO ₂ associated with space and water heating					1008.12	(376)
Pumps and fans	213.56	x	0.519	=	110.84	(378)
Electricity for lighting	396.26	x	0.519	=	205.66	(379)
Total CO ₂ , kg/year				(376)..(382) =	1324.61	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	13.63	(384)
EI value					87.52	
EI rating (section 14)					88	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	89.50					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	4568.95	x	1.22	=	5574.11 (367)
Electrical energy for community heat distribution	40.89	x	3.07	=	125.54	(372)
Total primary energy associated with community systems					5699.65	(373)
Total primary energy associated with space and water heating					5699.65	(376)
Pumps and fans	213.56	x	3.07	=	655.62	(378)
Electricity for lighting	396.26	x	3.07	=	1216.53	(379)
Primary energy kWh/year					7571.79	(383)
Dwelling primary energy rate kWh/m ² /year					77.92	(384)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr AECOM Planner	Assessor number	101
Client	Default Client	Last modified	30/08/2018
Address	2.5 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	97.18 (1a) x	2.62 (2a) =	254.61 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 97.18 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	254.61 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	3 x 10 =	30 (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) = 30 ÷ (5) = 0.12 (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 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Number of sides on which the dwelling is sheltered (19)

Shelter factor 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (18) x (20) = (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

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
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m

0.40	0.39	0.38	0.34	0.34	0.30	0.30	0.29	0.31	0.34	0.35	0.37
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (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
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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
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Window			22.74	1.33	30.15		(27)						
External wall			35.02	0.18	6.30		(29a)						
Party wall			57.76	0.00	0.00		(32)						
Total area of external elements ΣA, m ²			57.76				(31)						
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	36.45 (33)						
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)						
Thermal mass parameter (TMP) in kJ/m ² K							250.00 (35)						
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							2.89 (36)						
Total fabric heat loss						(33) + (36) =	39.34 (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)	48.69	48.43	48.17	46.98	46.76	45.72	45.72	45.52	46.12	46.76	47.21	47.68	(38)
Heat transfer coefficient, W/K (37)m + (38)m	88.03	87.77	87.51	86.32	86.10	85.06	85.06	84.86	85.46	86.10	86.55	87.02	
	Average = Σ(39)1...12/12 =											86.32	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.91	0.90	0.90	0.89	0.89	0.88	0.88	0.87	0.88	0.89	0.89	0.90	
	Average = Σ(40)1...12/12 =											0.89	(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												2.71	(42)	
Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$												98.61	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)														
	108.47	104.52	100.58	96.63	92.69	88.75	88.75	92.69	96.63	100.58	104.52	108.47		
												$\Sigma(44)1...12 =$	1183.27	(44)
Energy content of hot water used = $4.18 \times V_{d,m} \times n_m \times T_m / 3600$ kWh/month (see Tables 1b, 1c 1d)														
	160.85	140.68	145.17	126.56	121.44	104.80	97.11	111.43	112.76	131.42	143.45	155.78		
												$\Sigma(45)1...12 =$	1551.46	(45)
Distribution loss $0.15 \times (45)m$														
	24.13	21.10	21.78	18.98	18.22	15.72	14.57	16.71	16.91	19.71	21.52	23.37	(46)	
Storage volume (litres) including any solar or WWHRS storage within same vessel												180.00	(47)	
Water storage loss:														
a) If manufacturer's declared loss factor is known (kWh/day)												1.55	(48)	
Temperature factor from Table 2b												0.54	(49)	
Energy lost from water storage (kWh/day) (48) x (49)												0.84	(50)	
Enter (50) or (54) in (55)												0.84	(55)	
Water storage loss calculated for each month (55) x (41)m														
	25.98	23.47	25.98	25.14	25.98	25.14	25.98	25.98	25.14	25.98	25.14	25.98	(56)	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - V_s] ÷ (47), else (56)														
	25.98	23.47	25.98	25.14	25.98	25.14	25.98	25.98	25.14	25.98	25.14	25.98	(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)
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Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

210.10	185.16	194.42	174.22	170.68	152.45	146.35	160.68	160.42	180.66	191.10	205.02	(62)
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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)
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Output from water heater for each month (kWh/month) (62)m + (63)m

210.10	185.16	194.42	174.22	170.68	152.45	146.35	160.68	160.42	180.66	191.10	205.02	
$\Sigma(64)1...12 =$											2131.25	(64)

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

92.88	82.36	87.66	80.21	79.77	72.97	71.68	76.45	75.62	83.09	85.82	91.19	(65)
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5. Internal gains

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

Metabolic gains (Table 5)

135.59	135.59	135.59	135.59	135.59	135.59	135.59	135.59	135.59	135.59	135.59	135.59	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

22.44	19.93	16.21	12.27	9.17	7.74	8.37	10.88	14.60	18.53	21.63	23.06	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

251.69	254.30	247.72	233.71	216.02	199.40	188.29	185.68	192.26	206.27	223.96	240.58	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.56	36.56	36.56	36.56	36.56	36.56	36.56	36.56	36.56	36.56	36.56	36.56	(69)
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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)

-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	-108.47	(71)
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Water heating gains (Table 5)

124.84	122.56	117.83	111.40	107.22	101.34	96.35	102.75	105.02	111.68	119.20	122.57	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

465.64	463.46	448.43	424.05	399.09	375.16	359.68	365.98	378.56	403.16	431.46	452.89	(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

North $0.77 \times 10.26 \times 10.63 \times 0.9 \times 0.63 \times 0.70 = 33.34$ (74)

East $0.77 \times 12.48 \times 19.64 \times 0.9 \times 0.63 \times 0.70 = 74.91$ (76)

Solar gains in watts $\Sigma(74)m...(82)m$

108.25	210.26	349.60	525.87	665.62	692.36	654.53	546.87	410.85	249.73	134.53	89.40	(83)
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Total gains - internal and solar (73)m + (83)m

573.89	673.72	798.03	949.93	1064.71	1067.52	1014.22	912.85	789.41	652.89	566.00	542.29	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00	(85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.98	0.90	0.72	0.51	0.37	0.43	0.71	0.96	1.00	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

20.09	20.25	20.51	20.81	20.96	21.00	21.00	21.00	20.97	20.73	20.35	20.07	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.16	20.16	20.17	20.18	20.18	20.19	20.19	20.19	20.19	20.18	20.18	20.17	(88)
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Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.97	0.87	0.66	0.44	0.30	0.35	0.64	0.94	0.99	1.00	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.94	19.17	19.54	19.96	20.14	20.19	20.19	20.19	20.16	19.87	19.33	18.91	(90)
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Living area fraction

Living area ÷ (4) = 0.42 (91)

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

19.43	19.63	19.95	20.32	20.49	20.53	20.53	20.53	20.51	20.23	19.76	19.40	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.43	19.63	19.95	20.32	20.49	20.53	20.53	20.53	20.51	20.23	19.76	19.40	(93)
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8. Space heating requirement

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

Utilisation factor for gains, ηm

1.00	0.99	0.97	0.88	0.68	0.47	0.33	0.38	0.67	0.94	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

571.98	667.70	772.84	832.87	728.30	501.99	334.29	350.24	529.33	614.77	561.40	540.98	(95)
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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]

1331.87	1292.61	1177.13	985.77	756.88	504.38	334.50	350.77	547.57	829.19	1095.96	1322.91	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

565.36	419.94	300.79	110.09	21.26	0.00	0.00	0.00	0.00	159.52	384.88	581.75	
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Σ(98)1...5, 10...12 = 2543.59 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 26.17 (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

604.66	449.13	321.70	117.74	22.74	0.00	0.00	0.00	0.00	170.61	411.63	622.20	
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Σ(211)1...5, 10...12 = 2720.41 (211)

Water heating

Efficiency of water heater

87.33	86.93	85.97	83.63	80.86	79.80	79.80	79.80	79.80	84.48	86.65	87.44	(217)
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Water heating fuel, kWh/month

240.58	212.99	226.13	208.32	211.09	191.04	183.40	201.35	201.03	213.84	220.56	234.46	
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Σ(219a)1...12 = 2544.79 (219)

Annual totals

Space heating fuel - main system 1

2720.41

Water heating fuel

2544.79

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)

396.26

(232)

Total delivered energy for all uses

(211)...(221) + (231) + (232)...(237b) =

5736.46

(238)

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

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2720.41	x	3.48	x 0.01 =	94.67	(240)
Water heating	2544.79	x	3.48	x 0.01 =	88.56	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	396.26	x	13.19	x 0.01 =	52.27	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	365.39	(255)

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

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.08	(257)
SAP value	84.94	
SAP rating (section 13)	85	(258)
SAP band	B	

12a. CO₂ 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	2720.41	x	0.216	=	587.61	(261)
Water heating	2544.79	x	0.216	=	549.67	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1137.28	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	396.26	x	0.519	=	205.66	(268)
Total CO ₂ , kg/year				(265)...(271) =	1381.87	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	14.22	(273)
EI value					86.98	
EI rating (section 14)					87	(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	2720.41	x	1.22	=	3318.90	(261)
Water heating	2544.79	x	1.22	=	3104.64	(264)
Space and water heating				(261) + (262) + (263) + (264) =	6423.54	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	396.26	x	3.07	=	1216.53	(268)
Primary energy kWh/year					7870.32	(272)
Dwelling primary energy rate kWh/m ² /year					80.99	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr AECOM Planner	Assessor number	101
Client	Default Client	Last modified	30/08/2018
Address	2.9 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	88.30 (1a) x	2.62 (2a) =	231.35 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 88.30 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	231.35 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (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) = 0 ÷ (5) = 0.00 (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	3.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
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Number of sides on which the dwelling is sheltered	3 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.12 (21)
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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)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery; efficiency in % allowing for in-use factor from Table 4h	76.50 (23c)
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a) If balanced mechanical ventilation with heat recovery (MVHR) (22b)m + (23b) x [1 - (23c) ÷ 100]

0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.23	0.24	0.25	0.25 (24a)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Window			17.21	1.33	22.82		(27)						
External wall			33.56	0.18	6.04		(29a)						
Party wall			77.50	0.00	0.00		(32)						
Total area of external elements ΣA, m ²			50.77				(31)						
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	28.86 (33)						
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)						
Thermal mass parameter (TMP) in kJ/m ² K							100.00 (35)						
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							7.62 (36)						
Total fabric heat loss						(33) + (36) =	36.47 (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)	20.29	20.06	19.84	18.73	18.51	17.40	17.40	17.18	17.85	18.51	18.95	19.40	(38)
Heat transfer coefficient, W/K (37)m + (38)m	56.76	56.54	56.31	55.21	54.98	53.87	53.87	53.65	54.32	54.98	55.43	55.87	
	Average = Σ(39)1...12/12 =											55.15 (39)	
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.64	0.64	0.64	0.63	0.62	0.61	0.61	0.61	0.62	0.62	0.63	0.63	
	Average = Σ(40)1...12/12 =											0.62 (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												2.60	(42)	
Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$												95.99	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)														
	105.59	101.75	97.91	94.07	90.23	86.39	86.39	90.23	94.07	97.91	101.75	105.59		
												$\Sigma(44)_{1...12} =$	1151.89	(44)
Energy content of hot water used = $4.18 \times V_{d,m} \times n_m \times T_m / 3600$ kWh/month (see Tables 1b, 1c 1d)														
	156.59	136.95	141.32	123.21	118.22	102.02	94.53	108.48	109.77	127.93	139.65	151.65		
												$\Sigma(45)_{1...12} =$	1510.31	(45)
Distribution loss $0.15 \times (45)m$														
	23.49	20.54	21.20	18.48	17.73	15.30	14.18	16.27	16.47	19.19	20.95	22.75	(46)	
Storage volume (litres) including any solar or WWHRS storage within same vessel												180.00	(47)	
Water storage loss:														
a) If manufacturer's declared loss factor is known (kWh/day)												1.85	(48)	
Temperature factor from Table 2b												0.60	(49)	
Energy lost from water storage (kWh/day) (48) x (49)												1.11	(50)	
Enter (50) or (54) in (55)												1.11	(55)	
Water storage loss calculated for each month (55) x (41)m														
	34.41	31.08	34.41	33.30	34.41	33.30	34.41	34.41	33.30	34.41	33.30	34.41	(56)	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - V_s] ÷ (47), else (56)														
	34.41	31.08	34.41	33.30	34.41	33.30	34.41	34.41	33.30	34.41	33.30	34.41	(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)
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Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

214.26	189.04	198.99	179.02	175.89	157.83	152.21	166.15	165.59	185.60	195.46	209.32	(62)
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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)
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Output from water heater for each month (kWh/month) (62)m + (63)m

214.26	189.04	198.99	179.02	175.89	157.83	152.21	166.15	165.59	185.60	195.46	209.32	
$\Sigma(64)1...12 =$											2189.36	(64)

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

98.20	87.21	93.13	85.62	85.45	78.57	77.57	82.21	81.15	88.67	91.08	96.56	(65)
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5. Internal gains

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

Metabolic gains (Table 5)

130.09	130.09	130.09	130.09	130.09	130.09	130.09	130.09	130.09	130.09	130.09	130.09	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

21.03	18.68	15.19	11.50	8.60	7.26	7.84	10.19	13.68	17.37	20.28	21.62	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

235.92	238.36	232.19	219.06	202.48	186.90	176.49	174.04	180.21	193.35	209.92	225.51	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	(69)
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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)

-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	(71)
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Water heating gains (Table 5)

131.99	129.78	125.17	118.91	114.85	109.12	104.26	110.49	112.71	119.19	126.50	129.79	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

450.97	448.85	434.58	411.50	387.95	365.31	350.62	356.76	368.63	391.93	418.73	438.93	(73)
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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

East 0.77 x 17.21 x 19.64 x 0.9 x 0.45 x 0.80 = 84.33 (76)

Solar gains in watts $\Sigma(74)m...(82)m$

84.33	164.96	271.67	396.21	485.57	497.07	473.23	406.50	315.96	195.74	105.15	69.35	(83)
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Total gains - internal and solar (73)m + (83)m

535.29	613.81	706.25	807.71	873.52	862.38	823.85	763.25	684.59	587.67	523.88	508.28	(84)
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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)

0.95	0.92	0.85	0.72	0.55	0.39	0.29	0.32	0.52	0.79	0.92	0.96	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.92	20.15	20.47	20.78	20.93	20.99	21.00	21.00	20.96	20.73	20.28	19.88	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.39	20.39	20.40	20.41	20.41	20.42	20.42	20.42	20.42	20.41	20.41	20.40
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(88)

Utilisation factor for gains for rest of dwelling n2,m

0.94	0.91	0.83	0.69	0.52	0.36	0.25	0.28	0.49	0.76	0.91	0.95
------	------	------	------	------	------	------	------	------	------	------	------

(89)

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

18.92	19.25	19.70	20.13	20.33	20.41	20.42	20.42	20.38	20.08	19.46	18.88
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(90)

Living area fraction

Living area ÷ (4) = 0.45 (91)

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

19.38	19.66	20.05	20.43	20.61	20.67	20.68	20.68	20.64	20.38	19.83	19.34
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(92)

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

19.38	19.66	20.05	20.43	20.61	20.67	20.68	20.68	20.64	20.38	19.83	19.34
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(93)

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.93	0.90	0.83	0.69	0.53	0.37	0.27	0.30	0.50	0.76	0.90	0.94
------	------	------	------	------	------	------	------	------	------	------	------

(94)

Useful gains, ηmGm, W (94)m x (84)m

499.19	550.61	583.11	560.73	466.84	323.02	219.13	228.48	342.55	447.72	469.95	478.38
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(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]

855.79	834.37	763.03	636.42	489.70	327.11	219.91	229.73	355.35	537.53	705.82	845.70
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(97)

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

265.31	190.69	133.86	54.50	17.01	0.00	0.00	0.00	0.00	66.82	169.83	273.29
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Σ(98)1...5, 10...12 = 1171.30 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 13.27 (99)

9b. Energy requirements - community heating scheme

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

'0' if none 0.00 (301)

Fraction of space heat from community system

1 - (301) = 1.00 (302)

Fraction of community heat from boilers

1.00 (303a)

Fraction of total space heat from community boilers

(302) x (303a) = 1.00 (304a)

Factor for control and charging method (Table 4c(3)) for community space heating

1.00 (305)

Factor for charging method (Table 4c(3)) for community water heating

1.00 (305a)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

1171.30 (98)

Space heat from boilers

(98) x (304a) x (305) x (306) = 1229.87 (307a)

Water heating

Annual water heating requirement

2189.36 (64)

Water heat from boilers

(64) x (303a) x (305a) x (306) = 2298.83 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 35.29 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside

194.04 (330a)

Total electricity for the above, kWh/year

194.04 (331)

Electricity for lighting (Appendix L)

371.44 (332)

Total delivered energy for all uses

$$(307) + (309) + (310) + (312) + (315) + (331) + (332) \dots (337b) = 4094.17 \quad (338)$$

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1229.87	x	4.24	x 0.01 =	52.15	(340a)
Water heating from boilers	2298.83	x	4.24	x 0.01 =	97.47	(342a)
Pumps and fans	194.04	x	13.19	x 0.01 =	25.59	(349)
Electricity for lighting	371.44	x	13.19	x 0.01 =	48.99	(350)
Additional standing charges					120.00	(351)
Total energy cost				(340a) \dots (342e) + (345) \dots (354) =	344.20	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.08	(357)
SAP value	84.87	
SAP rating (section 13)	85	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	89.50					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 3942.67	x	0.216	=	851.62	(367)
Electrical energy for community heat distribution	35.29	x	0.519	=	18.31	(372)
Total CO ₂ associated with community systems					869.93	(373)
Total CO ₂ associated with space and water heating					869.93	(376)
Pumps and fans	194.04	x	0.519	=	100.71	(378)
Electricity for lighting	371.44	x	0.519	=	192.78	(379)
Total CO ₂ , kg/year				(376) \dots (382) =	1163.42	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	13.18	(384)
EI value					88.30	
EI rating (section 14)					88	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	89.50					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 3942.67	x	1.22	=	4810.06	(367)
Electrical energy for community heat distribution	35.29	x	3.07	=	108.33	(372)
Total primary energy associated with community systems					4918.39	(373)
Total primary energy associated with space and water heating					4918.39	(376)
Pumps and fans	194.04	x	3.07	=	595.71	(378)
Electricity for lighting	371.44	x	3.07	=	1140.32	(379)
Primary energy kWh/year					6654.42	(383)
Dwelling primary energy rate kWh/m ² /year					75.36	(384)

TER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr AECOM Planner	Assessor number	101
Client	Default Client	Last modified	30/08/2018
Address	2.9 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)		Average storey height (m)		Volume (m ³)
Lowest occupied	88.30 (1a)	x	2.62 (2a)	=	231.35 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 88.30 (4)				
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) = 231.35 (5)				

2. Ventilation rate

			m ³ per hour
Number of chimneys	0	x 40 =	0 (6a)
Number of open flues	0	x 20 =	0 (6b)
Number of intermittent fans	3	x 10 =	30 (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) = 30 ÷ (5) = 0.13 (8)

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

Air permeability value, q ₅₀ , 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)	0.38 (18)
--	--

Number of sides on which the dwelling is sheltered	3 (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = 0.78 (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = 0.29 (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)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m

0.38	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.35 (22b)
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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

0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56 (24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Window			17.21	1.33	22.82		(27)						
External wall			33.56	0.18	6.04		(29a)						
Party wall			77.50	0.00	0.00		(32)						
Total area of external elements ΣA, m ²			50.77				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	28.86	(33)						
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)						
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						2.54	(36)						
Total fabric heat loss					(33) + (36) =	31.40	(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)	43.54	43.34	43.13	42.17	41.99	41.15	41.15	41.00	41.48	41.99	42.36	42.74	(38)
Heat transfer coefficient, W/K (37)m + (38)m	74.94	74.73	74.53	73.57	73.39	72.55	72.55	72.40	72.87	73.39	73.75	74.13	
	Average = Σ(39)1...12/12 =											73.57	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.85	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.83	0.83	0.84	0.84	
	Average = Σ(40)1...12/12 =											0.83	(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

2.60(42)

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

95.99(43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)

105.59	101.75	97.91	94.07	90.23	86.39	86.39	90.23	94.07	97.91	101.75	105.59
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$\Sigma(44)1...12 =$ 1151.89(44)

Energy content of hot water used = $4.18 \times V_{d,m} \times n_m \times T_m / 3600$ kWh/month (see Tables 1b, 1c 1d)

156.59	136.95	141.32	123.21	118.22	102.02	94.53	108.48	109.77	127.93	139.65	151.65
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$\Sigma(45)1...12 =$ 1510.31(45)

Distribution loss $0.15 \times (45)m$

23.49	20.54	21.20	18.48	17.73	15.30	14.18	16.27	16.47	19.19	20.95	22.75
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(46)

Storage volume (litres) including any solar or WWHRs storage within same vessel

180.00(47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day)

1.55(48)

Temperature factor from Table 2b

0.54(49)

Energy lost from water storage (kWh/day) (48) x (49)

0.84(50)

Enter (50) or (54) in (55)

0.84(55)

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

25.98	23.47	25.98	25.14	25.98	25.14	25.98	25.98	25.14	25.98	25.14	25.98
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

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

25.98	23.47	25.98	25.14	25.98	25.14	25.98	25.98	25.14	25.98	25.14	25.98
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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
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(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 $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

205.83	181.43	190.57	170.86	167.46	149.67	143.78	157.72	157.43	177.17	187.30	200.89	(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

205.83	181.43	190.57	170.86	167.46	149.67	143.78	157.72	157.43	177.17	187.30	200.89	
$\Sigma(64)1...12 =$											2090.11	(64)

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

91.46	81.12	86.38	79.09	78.70	72.04	70.83	75.46	74.62	81.93	84.56	89.82	(65)
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5. Internal gains

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

Metabolic gains (Table 5)

130.09	130.09	130.09	130.09	130.09	130.09	130.09	130.09	130.09	130.09	130.09	130.09	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

21.24	18.87	15.34	11.62	8.68	7.33	7.92	10.30	13.82	17.55	20.48	21.83	(67)
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------	------

Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

235.92	238.36	232.19	219.06	202.48	186.90	176.49	174.04	180.21	193.35	209.92	225.51	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	(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)

-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	-104.07	(71)
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Water heating gains (Table 5)

122.93	120.71	116.11	109.85	105.78	100.06	95.20	101.43	103.64	110.12	117.44	120.72	(72)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

445.11	442.97	428.67	405.55	381.97	359.32	344.64	350.79	362.70	386.04	412.87	433.09	(73)
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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

East 0.77 x 17.21 x 19.64 x 0.9 x 0.63 x 0.70 = 103.30 (76)

Solar gains in watts $\Sigma(74)m...(82)m$

103.30	202.08	332.79	485.36	594.82	608.91	579.70	497.96	387.05	239.78	128.80	84.95	(83)
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Total gains - internal and solar (73)m + (83)m

548.41	645.04	761.46	890.91	976.80	968.23	924.34	848.75	749.75	625.82	541.67	518.03	(84)
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7. Mean internal temperature (heating season)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.00	(85)
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Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.97	0.87	0.68	0.48	0.35	0.39	0.65	0.94	0.99	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

20.21	20.37	20.61	20.87	20.98	21.00	21.00	21.00	20.99	20.80	20.45	20.18	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.21	20.21	20.22	20.22	20.23	20.23	20.23	20.24	20.23	20.23	20.22	20.22	(88)
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Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.96	0.84	0.63	0.42	0.29	0.33	0.59	0.91	0.99	1.00	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

19.15	19.38	19.73	20.08	20.21	20.23	20.23	20.24	20.22	20.00	19.51	19.11	(90)
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Living area fraction

Living area ÷ (4) = 0.45 (91)

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

19.63	19.83	20.13	20.44	20.56	20.58	20.58	20.58	20.57	20.37	19.94	19.60	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.63	19.83	20.13	20.44	20.56	20.58	20.58	20.58	20.57	20.37	19.94	19.60	(93)
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8. Space heating requirement

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

Utilisation factor for gains, ηm

1.00	0.99	0.96	0.85	0.65	0.45	0.31	0.36	0.62	0.92	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

545.98	637.05	728.23	753.50	634.27	432.77	288.86	302.65	463.04	575.10	535.58	516.38	(95)
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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)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1148.76	1115.56	1015.99	848.83	649.94	433.94	288.95	302.85	471.43	716.74	946.77	1141.40	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

448.47	321.56	214.09	68.64	11.66	0.00	0.00	0.00	0.00	105.38	296.06	465.01	
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Σ(98)1...5, 10...12 = 1930.87 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 21.87 (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
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Space heating fuel (main system 1), kWh/month

479.65	343.91	228.98	73.41	12.47	0.00	0.00	0.00	0.00	112.71	316.64	497.34	
--------	--------	--------	-------	-------	------	------	------	------	--------	--------	--------	--

Σ(211)1...5, 10...12 = 2065.10 (211)

Water heating

Efficiency of water heater

86.84	86.32	85.12	82.60	80.42	79.80	79.80	79.80	79.80	83.48	86.03	86.98	(217)
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Water heating fuel, kWh/month

237.03	210.17	223.87	206.86	208.24	187.56	180.17	197.64	197.28	212.23	217.71	230.96	
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Σ(219a)1...12 = 2509.71 (219)

Annual totals

Space heating fuel - main system 1

2065.10

Water heating fuel

2509.71

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)	375.13	(232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) = 5024.95	(238)

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

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2065.10	x	3.48	x 0.01 =	71.87	(240)
Water heating	2509.71	x	3.48	x 0.01 =	87.34	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	375.13	x	13.19	x 0.01 =	49.48	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	338.58	(255)

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

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.07	(257)
SAP value	85.12	
SAP rating (section 13)	85	(258)
SAP band	B	

12a. CO₂ 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	2065.10	x	0.216	=	446.06	(261)
Water heating	2509.71	x	0.216	=	542.10	(264)
Space and water heating			(261) + (262) + (263) + (264) =		988.16	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	375.13	x	0.519	=	194.69	(268)
Total CO ₂ , kg/year			(265)...(271) =		1221.78	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		13.84	(273)
EI value					87.72	
EI rating (section 14)					88	(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	2065.10	x	1.22	=	2519.43	(261)
Water heating	2509.71	x	1.22	=	3061.85	(264)
Space and water heating			(261) + (262) + (263) + (264) =		5581.28	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	375.13	x	3.07	=	1151.66	(268)
Primary energy kWh/year					6963.19	(272)
Dwelling primary energy rate kWh/m ² /year					78.86	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr AECOM Planner	Assessor number	101
Client	Default Client	Last modified	30/08/2018
Address	2.12 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	94.46 (1a)	2.62 (2a)	247.49 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 94.46 (4)		
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) = 247.49 (5)		

2. Ventilation rate

		m ³ per hour
Number of chimneys	0	0 (6a)
Number of open flues	0	0 (6b)
Number of intermittent fans	0	0 (7a)
Number of passive vents	0	0 (7b)
Number of flueless gas fires	0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 0 ÷ (5) = 0.00 (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	3.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
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Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.13 (21)
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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

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
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15
---	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50 (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	76.50 (23c)
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a) If balanced mechanical ventilation with heat recovery (MVHR) (22b)m + (23b) x [1 - (23c) ÷ 100]

	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.25	0.25	0.26	0.27
--	------	------	------	------	------	------	------	------	------	------	------	------

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

	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.25	0.25	0.26	0.27
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Window			18.06	1.33	23.94		(27)						
External wall			39.26	0.18	7.07		(29a)						
Party wall			64.37	0.00	0.00		(32)						
Total area of external elements ΣA, m ²			57.32				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	31.01	(33)						
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						100.00	(35)						
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						8.60	(36)						
Total fabric heat loss					(33) + (36) =	39.61	(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)	22.87	22.61	22.35	21.05	20.79	19.49	19.49	19.23	20.01	20.79	21.31	21.83	(38)
Heat transfer coefficient, W/K (37)m + (38)m	62.48	62.22	61.96	60.66	60.40	59.10	59.10	58.84	59.62	60.40	60.92	61.44	
	Average = Σ(39)1...12/12 =											60.59	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.66	0.66	0.66	0.64	0.64	0.63	0.63	0.62	0.63	0.64	0.64	0.65	
	Average = Σ(40)1...12/12 =											0.64	(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												2.68	(42)	
Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$												97.90	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$														
	107.69	103.77	99.86	95.94	92.02	88.11	88.11	92.02	95.94	99.86	103.77	107.69		
												$\Sigma(44)1...12 =$	1174.77	(44)
Energy content of hot water used = $4.18 \times V_{d,m} \times n_m \times T_m / 3600$ kWh/month (see Tables 1b, 1c 1d)														
	159.70	139.67	144.13	125.65	120.57	104.04	96.41	110.63	111.95	130.47	142.42	154.66		
												$\Sigma(45)1...12 =$	1540.30	(45)
Distribution loss $0.15 \times (45)m$														
	23.95	20.95	21.62	18.85	18.09	15.61	14.46	16.59	16.79	19.57	21.36	23.20	(46)	
Storage volume (litres) including any solar or WWHRS storage within same vessel												180.00	(47)	
Water storage loss:														
a) If manufacturer's declared loss factor is known (kWh/day)												1.85	(48)	
Temperature factor from Table 2b												0.60	(49)	
Energy lost from water storage (kWh/day) $(48) \times (49)$												1.11	(50)	
Enter (50) or (54) in (55)												1.11	(55)	
Water storage loss calculated for each month $(55) \times (41)m$														
	34.41	31.08	34.41	33.30	34.41	33.30	34.41	34.41	33.30	34.41	33.30	34.41	(56)	
If the vessel contains dedicated solar storage or dedicated WWHRS $(56)m \times [(47) - V_s] \div (47)$, else (56)														
	34.41	31.08	34.41	33.30	34.41	33.30	34.41	34.41	33.30	34.41	33.30	34.41	(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 $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

217.37	191.76	201.80	181.47	178.24	159.85	154.08	168.30	167.77	188.14	198.23	212.33	(62)
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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

217.37	191.76	201.80	181.47	178.24	159.85	154.08	168.30	167.77	188.14	198.23	212.33	
$\Sigma(64)1...12 =$											2219.35	(64)

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

99.24	88.11	94.06	86.43	86.23	79.24	78.19	82.92	81.87	89.52	92.00	97.56	(65)
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5. Internal gains

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

Metabolic gains (Table 5)

134.10	134.10	134.10	134.10	134.10	134.10	134.10	134.10	134.10	134.10	134.10	134.10	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

22.04	19.57	15.92	12.05	9.01	7.61	8.22	10.68	14.34	18.20	21.25	22.65	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

247.05	249.61	243.15	229.40	212.04	195.72	184.82	182.26	188.72	202.47	219.83	236.15	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	(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)

-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	(71)
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Water heating gains (Table 5)

133.38	131.12	126.43	120.04	115.90	110.06	105.10	111.46	113.71	120.32	127.78	131.13	(72)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

465.70	463.54	448.73	424.72	400.17	376.62	361.37	367.62	380.00	404.23	432.09	453.16	(73)
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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 $0.77 \times 7.41 \times 46.75 \times 0.9 \times 0.45 \times 0.80 = 86.43$ (78)

East $0.77 \times 10.65 \times 19.64 \times 0.9 \times 0.45 \times 0.80 = 52.18$ (76)

Solar gains in watts $\Sigma(74)m...(82)m$

138.61	243.63	348.42	448.97	512.84	511.96	492.52	445.46	383.87	273.80	167.51	117.59	(83)
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Total gains - internal and solar (73)m + (83)m

604.31	707.17	797.14	873.69	913.01	888.58	853.89	813.09	763.87	678.03	599.60	570.75	(84)
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7. Mean internal temperature (heating season)

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

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 21.00 (85)

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

0.94	0.90	0.84	0.72	0.58	0.42	0.30	0.33	0.52	0.76	0.91	0.95	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.92	20.17	20.47	20.76	20.92	20.98	21.00	20.99	20.96	20.75	20.30	19.88	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.38	20.38	20.38	20.39	20.39	20.41	20.41	20.41	20.40	20.39	20.39	20.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling n2,m

0.94	0.89	0.82	0.70	0.54	0.38	0.26	0.29	0.48	0.74	0.89	0.95
------	------	------	------	------	------	------	------	------	------	------	------

 (89)

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

18.91	19.27	19.69	20.10	20.30	20.39	20.40	20.41	20.36	20.09	19.47	18.86
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 (90)

Living area fraction

Living area ÷ (4) = 0.46 (91)

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

19.38	19.69	20.05	20.40	20.59	20.66	20.68	20.68	20.64	20.39	19.86	19.33
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 (92)

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

19.38	19.69	20.05	20.40	20.59	20.66	20.68	20.68	20.64	20.39	19.86	19.33
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 (93)

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.92	0.88	0.81	0.70	0.55	0.40	0.28	0.31	0.49	0.74	0.88	0.93
------	------	------	------	------	------	------	------	------	------	------	------

 (94)

Useful gains, ηmGm, W (94)m x (84)m

558.83	623.64	647.95	609.78	506.59	352.46	239.86	250.06	375.76	500.54	529.64	533.55
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 (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
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 (96)

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

942.23	920.26	839.86	697.85	536.74	358.40	241.01	251.71	389.80	591.51	777.15	929.84
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 (97)

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

285.25	199.33	142.79	63.41	22.44	0.00	0.00	0.00	0.00	67.68	178.21	294.84
--------	--------	--------	-------	-------	------	------	------	------	-------	--------	--------

Σ(98)1...5, 10...12 = 1253.94 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 13.27 (99)

9b. Energy requirements - community heating scheme

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

'0' if none 0.00 (301)

Fraction of space heat from community system

1 - (301) = 1.00 (302)

Fraction of community heat from boilers

1.00 (303a)

Fraction of total space heat from community boilers

(302) x (303a) = 1.00 (304a)

Factor for control and charging method (Table 4c(3)) for community space heating

1.00 (305)

Factor for charging method (Table 4c(3)) for community water heating

1.00 (305a)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

1253.94 (98)

Space heat from boilers

(98) x (304a) x (305) x (306) = 1316.64 (307a)

Water heating

Annual water heating requirement

2219.35 (64)

Water heat from boilers

(64) x (303a) x (305a) x (306) = 2330.32 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 36.47 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

207.58 (330a)

mechanical ventilation fans - balanced, extract or positive input from outside

Total electricity for the above, kWh/year

207.58 (331)

Electricity for lighting (Appendix L)

389.19 (332)

Total delivered energy for all uses

(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 4243.72 (338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1316.64	x	4.24	x 0.01 =	55.83	(340a)
Water heating from boilers	2330.32	x	4.24	x 0.01 =	98.81	(342a)
Pumps and fans	207.58	x	13.19	x 0.01 =	27.38	(349)
Electricity for lighting	389.19	x	13.19	x 0.01 =	51.33	(350)
Additional standing charges					120.00	(351)
Total energy cost				(340a)...(342e) + (345)...(354) =	353.34	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.06	(357)
SAP value	85.16	
SAP rating (section 13)	85	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	89.50					(367a)
CO ₂ emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) =	4074.81	x	0.216	=	880.16	(367)
Electrical energy for community heat distribution	36.47	x	0.519	=	18.93	(372)
Total CO ₂ associated with community systems					899.09	(373)
Total CO ₂ associated with space and water heating					899.09	(376)
Pumps and fans	207.58	x	0.519	=	107.73	(378)
Electricity for lighting	389.19	x	0.519	=	201.99	(379)
Total CO ₂ , kg/year				(376)...(382) =	1208.81	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	12.80	(384)
EI value					88.39	
EI rating (section 14)					88	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	89.50					(367a)
Primary energy from boilers [(307a)+(310a)] x 100 ÷ (367a) =	4074.81	x	1.22	=	4971.27	(367)
Electrical energy for community heat distribution	36.47	x	3.07	=	111.96	(372)
Total primary energy associated with community systems					5083.23	(373)
Total primary energy associated with space and water heating					5083.23	(376)
Pumps and fans	207.58	x	3.07	=	637.27	(378)
Electricity for lighting	389.19	x	3.07	=	1194.80	(379)
Primary energy kWh/year					6915.30	(383)
Dwelling primary energy rate kWh/m ² /year					73.21	(384)

TER Worksheet

Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr AECOM Planner	Assessor number	101
Client	Default Client	Last modified	30/08/2018
Address	2.12 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	94.46 (1a)	2.62 (2a)	247.49 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 94.46 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 247.49 (5)	

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	3 x 10 =	30 (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) = 30 ÷ (5) = 0.12 (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	5.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.37 (18)
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Number of sides on which the dwelling is sheltered	2 (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.32 (21)
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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

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
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.40	0.39	0.39	0.35	0.34	0.30	0.30	0.29	0.32	0.34	0.35	0.37
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A (23a)
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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
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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
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Window			18.06	1.33	23.94		(27)						
External wall			39.26	0.18	7.07		(29a)						
Party wall			64.37	0.00	0.00		(32)						
Total area of external elements ΣA, m ²			57.32				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	31.01	(33)						
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)						
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						2.87	(36)						
Total fabric heat loss					(33) + (36) =	33.88	(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)	47.44	47.19	46.94	45.75	45.53	44.50	44.50	44.31	44.90	45.53	45.98	46.45	(38)
Heat transfer coefficient, W/K (37)m + (38)m	81.32	81.06	80.81	79.63	79.41	78.38	78.38	78.19	78.78	79.41	79.86	80.32	
	Average = Σ(39)1...12/12 =											79.63	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.86	0.86	0.86	0.84	0.84	0.83	0.83	0.83	0.83	0.84	0.85	0.85	
	Average = Σ(40)1...12/12 =											0.84	(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												2.68	(42)	
Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$												97.90	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$														
	107.69	103.77	99.86	95.94	92.02	88.11	88.11	92.02	95.94	99.86	103.77	107.69		
												$\Sigma(44)1...12 =$	1174.77	(44)
Energy content of hot water used = $4.18 \times V_{d,m} \times n_m \times T_m / 3600$ kWh/month (see Tables 1b, 1c 1d)														
	159.70	139.67	144.13	125.65	120.57	104.04	96.41	110.63	111.95	130.47	142.42	154.66		
												$\Sigma(45)1...12 =$	1540.30	(45)
Distribution loss $0.15 \times (45)m$														
	23.95	20.95	21.62	18.85	18.09	15.61	14.46	16.59	16.79	19.57	21.36	23.20	(46)	
Storage volume (litres) including any solar or WWHRs storage within same vessel												180.00	(47)	
Water storage loss:														
a) If manufacturer's declared loss factor is known (kWh/day)												1.55	(48)	
Temperature factor from Table 2b												0.54	(49)	
Energy lost from water storage (kWh/day) $(48) \times (49)$												0.84	(50)	
Enter (50) or (54) in (55)												0.84	(55)	
Water storage loss calculated for each month $(55) \times (41)m$														
	25.98	23.47	25.98	25.14	25.98	25.14	25.98	25.98	25.14	25.98	25.14	25.98	(56)	
If the vessel contains dedicated solar storage or dedicated WWHRs $(56)m \times [(47) - V_s] \div (47)$, else (56)														
	25.98	23.47	25.98	25.14	25.98	25.14	25.98	25.98	25.14	25.98	25.14	25.98	(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)
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Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

208.94	184.15	193.37	173.31	169.81	151.70	145.65	159.87	159.61	179.71	190.07	203.90	(62)
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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

208.94	184.15	193.37	173.31	169.81	151.70	145.65	159.87	159.61	179.71	190.07	203.90	
$\Sigma(64)1...12 =$											2120.10	(64)

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

92.49	82.02	87.32	79.90	79.48	72.72	71.45	76.18	75.35	82.78	85.48	90.82	(65)
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5. Internal gains

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

Metabolic gains (Table 5)

134.10	134.10	134.10	134.10	134.10	134.10	134.10	134.10	134.10	134.10	134.10	134.10	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

22.30	19.80	16.11	12.19	9.11	7.70	8.31	10.81	14.51	18.42	21.50	22.92	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

247.05	249.61	243.15	229.40	212.04	195.72	184.82	182.26	188.72	202.47	219.83	236.15	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	(69)
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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)

-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	-107.28	(71)
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Water heating gains (Table 5)

124.32	122.06	117.36	110.98	106.83	101.00	96.04	102.39	104.65	111.26	118.72	122.07	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

459.89	457.70	442.85	418.80	394.21	370.64	355.40	361.69	374.10	398.38	426.28	447.36	(73)
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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 $0.77 \times 7.41 \times 46.75 \times 0.9 \times 0.63 \times 0.70 = 105.87$ (78)

East $0.77 \times 10.65 \times 19.64 \times 0.9 \times 0.63 \times 0.70 = 63.92$ (76)

Solar gains in watts $\Sigma(74)m...(82)m$

169.80	298.45	426.81	549.99	628.23	627.15	603.34	545.69	470.25	335.41	205.20	144.05	(83)
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Total gains - internal and solar (73)m + (83)m

629.69	756.15	869.66	968.79	1022.44	997.80	958.74	907.38	844.35	733.78	631.48	591.42	(84)
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7. Mean internal temperature (heating season)

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

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 21.00 (85)

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

1.00	0.99	0.96	0.86	0.70	0.50	0.36	0.40	0.63	0.91	0.99	1.00	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

20.23	20.41	20.64	20.87	20.97	21.00	21.00	21.00	20.99	20.84	20.49	20.20	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.20	20.20	20.21	20.22	20.22	20.23	20.23	20.23	20.22	20.22	20.21	20.21	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.99	0.98	0.95	0.83	0.65	0.44	0.30	0.33	0.57	0.88	0.98	1.00	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

19.18	19.44	19.77	20.07	20.19	20.23	20.23	20.23	20.22	20.04	19.56	19.14	(90)
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Living area fraction

Living area ÷ (4) = 0.46 (91)

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

19.67	19.89	20.17	20.44	20.55	20.58	20.59	20.59	20.57	20.41	19.99	19.63	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.67	19.89	20.17	20.44	20.55	20.58	20.59	20.59	20.57	20.41	19.99	19.63	(93)
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8. Space heating requirement

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

Utilisation factor for gains, ηm

0.99	0.98	0.94	0.84	0.67	0.47	0.33	0.36	0.59	0.89	0.98	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

625.72	741.97	821.62	816.25	682.63	467.21	312.22	327.04	502.36	653.93	620.89	588.78	(95)
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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)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x ((93)m - (96)m]

1249.52	1215.13	1104.90	918.91	703.05	468.95	312.35	327.29	509.95	778.86	1029.28	1239.37	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

464.11	317.96	210.76	73.92	15.20	0.00	0.00	0.00	0.00	92.95	294.04	484.04	(98)
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Σ(98)1...5, 10...12 = 1952.98 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 20.68 (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 (203)

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

496.38	340.07	225.41	79.05	16.25	0.00	0.00	0.00	0.00	99.41	314.48	517.69	(211)
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Σ(211)1...5, 10...12 = 2088.75 (211)

Water heating

Efficiency of water heater

86.88	86.26	85.04	82.72	80.58	79.80	79.80	79.80	79.80	83.15	85.97	87.04	(217)
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Water heating fuel, kWh/month

240.48	213.49	227.38	209.50	210.73	190.10	182.52	200.34	200.01	216.13	221.08	234.26	(219)
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Σ(219a)1...12 = 2546.01 (219)

Annual totals

Space heating fuel - main system 1

2088.75

Water heating fuel

2546.01

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)

393.79

(232)

Total delivered energy for all uses

(211)...(221) + (231) + (232)...(237b) =

5103.55

(238)

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

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2088.75	x	3.48	x 0.01 =	72.69	(240)
Water heating	2546.01	x	3.48	x 0.01 =	88.60	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	393.79	x	13.19	x 0.01 =	51.94	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	343.12	(255)

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

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.03	(257)
SAP value	85.58	
SAP rating (section 13)	86	(258)
SAP band	B	

12a. CO₂ 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	2088.75	x	0.216	=	451.17	(261)
Water heating	2546.01	x	0.216	=	549.94	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1001.11	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	393.79	x	0.519	=	204.38	(268)
Total CO ₂ , kg/year			(265)...(271) =		1244.41	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		13.17	(273)
EI value					88.04	
EI rating (section 14)					88	(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	2088.75	x	1.22	=	2548.27	(261)
Water heating	2546.01	x	1.22	=	3106.14	(264)
Space and water heating			(261) + (262) + (263) + (264) =		5654.41	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	393.79	x	3.07	=	1208.92	(268)
Primary energy kWh/year					7093.59	(272)
Dwelling primary energy rate kWh/m ² /year					75.10	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr AECOM Planner	Assessor number	101
Client	Default Client	Last modified	30/08/2018
Address	2.15 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	82.75 (1a) x	2.62 (2a) =	216.81 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 82.75 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	216.81 (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	0 x 10 =	0 (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) = 0 ÷ (5) = 0.00 (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 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Number of sides on which the dwelling is sheltered (19)

Shelter factor 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (18) x (20) = (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)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15 (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (22b)m + (23b) x [1 - (23c) ÷ 100]

0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.25	0.25	0.26	0.27 (24a)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.25	0.25	0.26	0.27 (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Window			25.83	1.33	34.24		(27)						
External wall			28.59	0.18	5.15		(29a)						
Party wall			51.73	0.00	0.00		(32)						
Total area of external elements ΣA, m ²			54.42				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	39.39	(33)						
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						100.00	(35)						
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						8.16	(36)						
Total fabric heat loss					(33) + (36) =	47.55	(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)	20.04	19.81	19.58	18.44	18.21	17.07	17.07	16.84	17.53	18.21	18.67	19.13	(38)
Heat transfer coefficient, W/K (37)m + (38)m	67.59	67.36	67.13	65.99	65.77	64.63	64.63	64.40	65.08	65.77	66.22	66.68	
	Average = Σ(39)1...12/12 =											65.94	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.82	0.81	0.81	0.80	0.79	0.78	0.78	0.78	0.79	0.79	0.80	0.81	
	Average = Σ(40)1...12/12 =											0.80	(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												2.51	(42)	
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												93.88	(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)														
	103.27	99.52	95.76	92.01	88.25	84.49	84.49	88.25	92.01	95.76	99.52	103.27		
												Σ(44)1...12 =	1126.60	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)														
	153.15	133.94	138.22	120.50	115.63	99.78	92.46	106.10	107.36	125.12	136.58	148.32		
												Σ(45)1...12 =	1477.15	(45)
Distribution loss .015 x (45)m														
	22.97	20.09	20.73	18.08	17.34	14.97	13.87	15.91	16.10	18.77	20.49	22.25	(46)	
Storage volume (litres) including any solar or WWHRS storage within same vessel												180.00	(47)	
Water storage loss:														
a) If manufacturer's declared loss factor is known (kWh/day)												1.85	(48)	
Temperature factor from Table 2b												0.60	(49)	
Energy lost from water storage (kWh/day) (48) x (49)												1.11	(50)	
Enter (50) or (54) in (55)												1.11	(55)	
Water storage loss calculated for each month (55) x (41)m														
	34.41	31.08	34.41	33.30	34.41	33.30	34.41	34.41	33.30	34.41	33.30	34.41	(56)	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)														
	34.41	31.08	34.41	33.30	34.41	33.30	34.41	34.41	33.30	34.41	33.30	34.41	(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 $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

210.82	186.04	195.89	176.31	173.30	155.59	150.13	163.77	163.17	182.79	192.39	205.99	(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) $(62)m + (63)m$

210.82	186.04	195.89	176.31	173.30	155.59	150.13	163.77	163.17	182.79	192.39	205.99	
$\Sigma(64)1...12 =$											2156.19	(64)

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

97.06	86.21	92.10	84.72	84.58	77.83	76.88	81.41	80.35	87.74	90.06	95.45	(65)
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5. Internal gains

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

Metabolic gains (Table 5)

125.65	125.65	125.65	125.65	125.65	125.65	125.65	125.65	125.65	125.65	125.65	125.65	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

20.07	17.82	14.49	10.97	8.20	6.93	7.48	9.73	13.06	16.58	19.35	20.62	(67)
-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------	------

Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

225.09	227.43	221.54	209.01	193.19	178.33	168.40	166.06	171.95	184.48	200.29	215.16	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.56	35.56	35.56	35.56	35.56	35.56	35.56	35.56	35.56	35.56	35.56	35.56	(69)
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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)

-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	(71)
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Water heating gains (Table 5)

130.46	128.29	123.78	117.66	113.69	108.09	103.33	109.43	111.59	117.93	125.09	128.30	(72)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Total internal gains $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$

436.31	434.23	420.52	398.34	375.78	354.04	339.91	345.91	357.29	379.68	405.42	424.78	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains

Access factor
Table 6d

Area
 m^2

Solar flux
 W/m^2

g
specific data
or Table 6b

FF
specific data
or Table 6c

Gains
 W

South $0.77 \times 17.97 \times 46.75 \times 0.9 \times 0.45 \times 0.80 = 209.60$ (78)

West $0.77 \times 7.86 \times 19.64 \times 0.9 \times 0.45 \times 0.80 = 38.51$ (80)

Solar gains in watts $\Sigma(74)m... (82)m$

248.11	418.60	561.33	675.15	736.75	722.62	700.36	655.91	601.07	459.64	296.46	212.78	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

684.42	852.84	981.85	1073.49	1112.53	1076.66	1040.27	1001.82	958.36	839.32	701.89	637.56	(84)
--------	--------	--------	---------	---------	---------	---------	---------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, $Th1(^{\circ}C)$

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 21.00 (85)

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

0.91	0.85	0.76	0.65	0.51	0.37	0.27	0.29	0.45	0.69	0.86	0.93	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

19.77	20.12	20.45	20.74	20.90	20.97	20.99	20.99	20.95	20.73	20.22	19.70	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

20.24	20.24	20.24	20.26	20.26	20.27	20.27	20.27	20.27	20.27	20.26	20.25	20.25
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(88)

Utilisation factor for gains for rest of dwelling n2,m

0.90	0.83	0.74	0.62	0.48	0.33	0.23	0.25	0.41	0.65	0.84	0.92
------	------	------	------	------	------	------	------	------	------	------	------

(89)

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

18.60	19.09	19.55	19.94	20.15	20.25	20.27	20.27	20.22	19.94	19.25	18.51
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(90)

Living area fraction

Living area ÷ (4) = 0.52 (91)

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

19.21	19.63	20.02	20.36	20.54	20.63	20.65	20.65	20.60	20.36	19.76	19.13
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(92)

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

19.21	19.63	20.02	20.36	20.54	20.63	20.65	20.65	20.60	20.36	19.76	19.13
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(93)

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.89	0.82	0.74	0.62	0.49	0.35	0.25	0.27	0.43	0.66	0.83	0.90
------	------	------	------	------	------	------	------	------	------	------	------

(94)

Useful gains, ηmGm, W (94)m x (84)m

607.68	699.63	722.24	666.78	547.47	381.39	259.66	270.96	407.53	551.76	583.41	575.76
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(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]

1007.89	992.07	907.78	756.28	581.52	389.56	261.53	273.44	423.21	641.65	838.26	995.72
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(97)

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

297.76	196.52	138.04	64.44	25.33	0.00	0.00	0.00	0.00	66.88	183.49	312.45
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Σ(98)1...5, 10...12 = 1284.91 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 15.53 (99)

9b. Energy requirements - community heating scheme

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

'0' if none 0.00 (301)

Fraction of space heat from community system

1 - (301) = 1.00 (302)

Fraction of community heat from boilers

1.00 (303a)

Fraction of total space heat from community boilers

(302) x (303a) = 1.00 (304a)

Factor for control and charging method (Table 4c(3)) for community space heating

1.00 (305)

Factor for charging method (Table 4c(3)) for community water heating

1.00 (305a)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

1284.91 (98)

Space heat from boilers

(98) x (304a) x (305) x (306) = 1349.15 (307a)

Water heating

Annual water heating requirement

2156.19 (64)

Water heat from boilers

(64) x (303a) x (305a) x (306) = 2264.00 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 36.13 (313)

Electricity for pumps, fans and electric keep-hot (Table 4f)

181.85 (330a)

mechanical ventilation fans - balanced, extract or positive input from outside

Total electricity for the above, kWh/year

181.85 (331)

Electricity for lighting (Appendix L)

354.39 (332)

Total delivered energy for all uses

(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 4149.39 (338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1349.15	x	4.24	x 0.01 =	57.20	(340a)
Water heating from boilers	2264.00	x	4.24	x 0.01 =	95.99	(342a)
Pumps and fans	181.85	x	13.19	x 0.01 =	23.99	(349)
Electricity for lighting	354.39	x	13.19	x 0.01 =	46.74	(350)
Additional standing charges					120.00	(351)
Total energy cost				(340a)...(342e) + (345)...(354) =	343.93	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.13	(357)
SAP value	84.23	
SAP rating (section 13)	84	(358)
SAP band	B	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers	89.50					(367a)
CO ₂ emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 4037.05	x	0.216	=	872.00	(367)
Electrical energy for community heat distribution	36.13	x	0.519	=	18.75	(372)
Total CO ₂ associated with community systems					890.75	(373)
Total CO ₂ associated with space and water heating					890.75	(376)
Pumps and fans	181.85	x	0.519	=	94.38	(378)
Electricity for lighting	354.39	x	0.519	=	183.93	(379)
Total CO ₂ , kg/year				(376)..(382) =	1169.06	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	14.13	(384)
EI value					87.74	
EI rating (section 14)					88	(385)
EI band					B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sources (space heating)						
Efficiency of boilers	89.50					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) = 4037.05	x	1.22	=	4925.20	(367)
Electrical energy for community heat distribution	36.13	x	3.07	=	110.92	(372)
Total primary energy associated with community systems					5036.12	(373)
Total primary energy associated with space and water heating					5036.12	(376)
Pumps and fans	181.85	x	3.07	=	558.26	(378)
Electricity for lighting	354.39	x	3.07	=	1087.98	(379)
Primary energy kWh/year					6682.36	(383)
Dwelling primary energy rate kWh/m ² /year					80.75	(384)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr AECOM Planner	Assessor number	101
Client	Default Client	Last modified	30/08/2018
Address	2.15 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	82.75 (1a)	2.62 (2a)	216.81 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 82.75 (4)		
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) = 216.81 (5)		

2. Ventilation rate

		m ³ per hour
Number of chimneys	0 x 40 =	0 (6a)
Number of open flues	0 x 20 =	0 (6b)
Number of intermittent fans	3 x 10 =	30 (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) = 30 ÷ (5) = 0.14 (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	5.00 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.39 (18)
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Number of sides on which the dwelling is sheltered	2 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.85 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.33 (21)
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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

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
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.42	0.41	0.40	0.36	0.35	0.31	0.31	0.31	0.33	0.35	0.37	0.39
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A (23a)
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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

0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Window			20.68	1.33	27.42		(27)						
External wall			33.73	0.18	6.07		(29a)						
Party wall			51.73	0.00	0.00		(32)						
Total area of external elements ΣA, m ²			54.41				(31)						
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	33.49 (33)						
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)						
Thermal mass parameter (TMP) in kJ/m ² K							250.00 (35)						
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							2.72 (36)						
Total fabric heat loss						(33) + (36) =	36.21 (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)	42.11	41.86	41.62	40.49	40.28	39.29	39.29	39.11	39.67	40.28	40.71	41.16	(38)
Heat transfer coefficient, W/K (37)m + (38)m	78.32	78.07	77.83	76.70	76.49	75.50	75.50	75.32	75.88	76.49	76.92	77.36	
	Average = Σ(39)1...12/12 =											76.70	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.95	0.94	0.94	0.93	0.92	0.91	0.91	0.91	0.92	0.92	0.93	0.93	
	Average = Σ(40)1...12/12 =											0.93	(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	2.51 (42)												
Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$	93.88 (43)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
	103.27	99.52	95.76	92.01	88.25	84.49	84.49	88.25	92.01	95.76	99.52	103.27	
	$\Sigma(44)1...12 =$											1126.60	(44)
Energy content of hot water used = $4.18 \times V_{d,m} \times n_m \times T_m / 3600$ kWh/month (see Tables 1b, 1c 1d)													
	153.15	133.94	138.22	120.50	115.63	99.78	92.46	106.10	107.36	125.12	136.58	148.32	
	$\Sigma(45)1...12 =$											1477.15	(45)
Distribution loss $0.15 \times (45)m$													
	22.97	20.09	20.73	18.08	17.34	14.97	13.87	15.91	16.10	18.77	20.49	22.25	(46)
Storage volume (litres) including any solar or WWHRs storage within same vessel												180.00	(47)
Water storage loss:													
a) If manufacturer's declared loss factor is known (kWh/day)												1.55	(48)
Temperature factor from Table 2b												0.54	(49)
Energy lost from water storage (kWh/day) $(48) \times (49)$												0.84	(50)
Enter (50) or (54) in (55)												0.84	(55)
Water storage loss calculated for each month $(55) \times (41)m$													
	25.98	23.47	25.98	25.14	25.98	25.14	25.98	25.98	25.14	25.98	25.14	25.98	(56)
If the vessel contains dedicated solar storage or dedicated WWHRs $(56)m \times [(47) - V_s] \div (47)$, else (56)													
	25.98	23.47	25.98	25.14	25.98	25.14	25.98	25.98	25.14	25.98	25.14	25.98	(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)
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Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

202.39	178.42	187.46	168.16	164.87	147.43	141.70	155.34	155.02	174.36	184.23	197.56	(62)
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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) $(62)m + (63)m$

202.39	178.42	187.46	168.16	164.87	147.43	141.70	155.34	155.02	174.36	184.23	197.56	
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

$$\sum(64)1...12 = 2056.94 \quad (64)$$

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

90.32	80.12	85.35	78.19	77.84	71.30	70.14	74.67	73.82	81.00	83.54	88.71	(65)
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5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Metabolic gains (Table 5)

125.65	125.65	125.65	125.65	125.65	125.65	125.65	125.65	125.65	125.65	125.65	125.65	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

20.07	17.82	14.49	10.97	8.20	6.93	7.48	9.73	13.06	16.58	19.35	20.62	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

225.09	227.43	221.54	209.01	193.19	178.33	168.40	166.06	171.95	184.48	200.29	215.16	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.56	35.56	35.56	35.56	35.56	35.56	35.56	35.56	35.56	35.56	35.56	35.56	(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)

-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	-100.52	(71)
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Water heating gains (Table 5)

121.39	119.22	114.72	108.60	104.62	99.03	94.27	100.36	102.53	108.87	116.02	119.23	(72)
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Total internal gains $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$

430.25	428.17	414.45	392.28	369.71	347.97	333.84	339.84	351.22	373.61	399.36	418.71	(73)
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6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
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South $0.77 \times 14.38 \times 46.75 \times 0.9 \times 0.63 \times 0.70 = 205.46 \quad (78)$

West $0.77 \times 6.30 \times 19.64 \times 0.9 \times 0.63 \times 0.70 = 37.81 \quad (80)$

Solar gains in watts $\sum(74)m...(82)m$

243.28	410.47	550.46	662.12	722.57	708.73	686.89	643.27	589.44	450.72	290.69	208.63	(83)
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Total gains - internal and solar $(73)m + (83)m$

673.52	838.64	964.91	1054.40	1092.28	1056.70	1020.73	983.11	940.67	824.33	690.05	627.35	(84)
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7. Mean internal temperature (heating season)

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

$$21.00 \quad (85)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.99	0.97	0.91	0.80	0.63	0.46	0.33	0.35	0.55	0.84	0.97	0.99	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

20.24	20.47	20.71	20.90	20.98	21.00	21.00	21.00	20.99	20.88	20.53	20.20	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.13	20.13	20.13	20.14	20.15	20.16	20.16	20.16	20.15	20.15	20.14	20.14	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.99	0.96	0.89	0.76	0.58	0.40	0.26	0.29	0.48	0.80	0.96	0.99	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

19.14	19.47	19.79	20.04	20.13	20.16	20.16	20.16	20.15	20.03	19.56	19.08	(90)
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Living area fraction

Living area ÷ (4) = 0.52 (91)

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

19.72	19.99	20.27	20.49	20.57	20.60	20.60	20.60	20.59	20.47	20.07	19.67	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.72	19.99	20.27	20.49	20.57	20.60	20.60	20.60	20.59	20.47	20.07	19.67	(93)
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8. Space heating requirement

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

Utilisation factor for gains, ηm

0.99	0.96	0.90	0.77	0.61	0.43	0.30	0.32	0.52	0.82	0.96	0.99	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

663.79	802.80	864.94	816.86	663.33	451.22	301.75	316.05	487.73	673.60	664.62	620.88	(95)
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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)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1207.42	1178.45	1071.76	888.71	678.59	452.73	301.88	316.27	492.46	755.13	997.34	1196.61	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

404.46	252.44	153.87	51.73	11.35	0.00	0.00	0.00	0.00	60.66	239.56	428.34	(98)
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Σ(98)1...5, 10...12 = 1602.40 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 19.36 (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

432.58	269.99	164.57	55.32	12.14	0.00	0.00	0.00	0.00	64.87	256.21	458.12	(211)
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Σ(211)1...5, 10...12 = 1713.80 (211)

Water heating

Efficiency of water heater

86.63	85.74	84.29	82.08	80.41	79.80	79.80	79.80	79.80	82.31	85.52	86.83	(217)
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Water heating fuel, kWh/month

233.64	208.10	222.39	204.86	205.03	184.75	177.57	194.66	194.26	211.83	215.44	227.54	(219)
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Σ(219a)1...12 = 2480.06 (219)

Annual totals

Space heating fuel - main system 1

1713.80

Water heating fuel

2480.06

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)

354.39

(232)

Total delivered energy for all uses

(211)...(221) + (231) + (232)...(237b) =

4623.25

(238)

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

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	1713.80	x	3.48	x 0.01 =	59.64	(240)
Water heating	2480.06	x	3.48	x 0.01 =	86.31	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	354.39	x	13.19	x 0.01 =	46.74	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	322.58	(255)

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

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.06	(257)
SAP value	85.21	
SAP rating (section 13)	85	(258)
SAP band	B	

12a. CO₂ 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	1713.80	x	0.216	=	370.18	(261)
Water heating	2480.06	x	0.216	=	535.69	(264)
Space and water heating			(261) + (262) + (263) + (264) =		905.87	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	354.39	x	0.519	=	183.93	(268)
Total CO ₂ , kg/year				(265)...(271) =	1128.73	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	13.64	(273)
EI value					88.16	
EI rating (section 14)					88	(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	1713.80	x	1.22	=	2090.84	(261)
Water heating	2480.06	x	1.22	=	3025.67	(264)
Space and water heating			(261) + (262) + (263) + (264) =		5116.51	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	354.39	x	3.07	=	1087.98	(268)
Primary energy kWh/year					6434.74	(272)
Dwelling primary energy rate kWh/m ² /year					77.76	(273)

