

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	2.19 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	53.10 (1a)	2.62 (2a)	139.12 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 53.10 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 139.12 (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	0 (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	0.78 (20)
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Infiltration rate incorporating shelter factor	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

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	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
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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
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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
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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			10.65	1.33	14.12		(27)						
External wall			8.95	0.18	1.61		(29a)						
Party wall			63.88	0.00	0.00		(32)						
Total area of external elements ΣA, m ²			19.60				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	15.73	(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						2.94	(36)						
Total fabric heat loss					(33) + (36) =	18.67	(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)	12.20	12.07	11.93	11.27	11.13	10.46	10.46	10.33	10.73	11.13	11.40	11.67	(38)
Heat transfer coefficient, W/K (37)m + (38)m	30.87	30.74	30.60	29.94	29.80	29.13	29.13	29.00	29.40	29.80	30.07	30.34	(39)
	Average = Σ(39)1...12/12 =											29.90	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(40)
	Average = Σ(40)1...12/12 =											0.56	(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

1.78(42)

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

76.51(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)

84.16	81.10	78.04	74.98	71.92	68.86	68.86	71.92	74.98	78.04	81.10	84.16
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$\Sigma(44)_{1...12} = 918.13$ (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)

124.81	109.16	112.64	98.20	94.23	81.31	75.35	86.46	87.50	101.97	111.31	120.87
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$\Sigma(45)_{1...12} = 1203.81$ (45)

Distribution loss $0.15 \times (45)_m$

18.72	16.37	16.90	14.73	14.13	12.20	11.30	12.97	13.12	15.30	16.70	18.13
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180.00(47)

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

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

182.48	161.25	170.32	154.02	151.90	137.13	133.02	144.14	143.31	159.64	167.12	178.54	(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

182.48	161.25	170.32	154.02	151.90	137.13	133.02	144.14	143.31	159.64	167.12	178.54	
$\Sigma(64)1...12 =$											1882.86	(64)

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

87.64	77.97	83.59	77.30	77.47	71.69	71.19	74.89	73.74	80.04	81.66	86.33	(65)
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5. Internal gains

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

Metabolic gains (Table 5)

89.08	89.08	89.08	89.08	89.08	89.08	89.08	89.08	89.08	89.08	89.08	89.08	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

13.84	12.30	10.00	7.57	5.66	4.78	5.16	6.71	9.01	11.44	13.35	14.23	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

155.28	156.89	152.83	144.18	133.27	123.02	116.17	114.55	118.61	127.26	138.17	148.43	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

31.91	31.91	31.91	31.91	31.91	31.91	31.91	31.91	31.91	31.91	31.91	31.91	(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)
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Losses e.g. evaporation (Table 5)

-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	(71)
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Water heating gains (Table 5)

117.79	116.02	112.35	107.36	104.13	99.56	95.69	100.65	102.42	107.58	113.42	116.03	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

336.63	334.93	324.90	308.84	292.78	277.08	266.74	271.64	279.76	296.00	314.65	328.41	(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 x 10.65 x 19.64 x 0.9 x 0.45 x 0.80 = 52.18 (80)

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

52.18	102.08	168.11	245.18	300.48	307.60	292.85	251.55	195.52	121.13	65.07	42.91	(83)
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Total gains - internal and solar (73)m + (83)m

388.82	437.01	493.02	554.03	593.26	584.68	559.58	523.19	475.29	417.13	379.72	371.32	(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)

0.90	0.85	0.76	0.61	0.46	0.32	0.23	0.25	0.42	0.68	0.85	0.91	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

20.31	20.49	20.72	20.90	20.98	21.00	21.00	21.00	20.99	20.88	20.59	20.28	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.45	20.45	20.45	20.46	20.47	20.48	20.48	20.48	20.47	20.47	20.46	20.46	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.89	0.84	0.75	0.59	0.43	0.29	0.20	0.23	0.39	0.65	0.83	0.90	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

19.52	19.77	20.09	20.35	20.44	20.47	20.48	20.48	20.46	20.32	19.93	19.49	(90)
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Living area fraction

Living area ÷ (4) = 0.56 (91)

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

19.96	20.18	20.44	20.66	20.74	20.77	20.77	20.77	20.76	20.64	20.30	19.93	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.96	20.18	20.44	20.66	20.74	20.77	20.77	20.77	20.76	20.64	20.30	19.93	(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

0.88	0.84	0.75	0.60	0.45	0.31	0.22	0.24	0.41	0.66	0.83	0.90	(94)
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Useful gains, ηmGm, W (94)m x (84)m

343.66	365.14	367.67	331.83	264.44	178.99	121.41	126.60	193.28	274.70	314.37	332.48	(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]

483.54	469.58	426.68	352.07	269.45	179.71	121.53	126.79	195.74	299.16	397.06	477.32	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

104.08	70.19	43.91	14.57	3.73	0.00	0.00	0.00	0.00	18.20	59.54	107.76	
										Σ(98)1...5, 10...12 =	421.96	(98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 7.95 (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

421.96 (98)

Space heat from boilers

(98) x (304a) x (305) x (306) = 443.06 (307a)

Water heating

Annual water heating requirement

1882.86 (64)

Water heat from boilers

(64) x (303a) x (305a) x (306) = 1977.00 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 24.20 (313)

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

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

116.69 (330a)

Total electricity for the above, kWh/year

116.69 (331)

Electricity for lighting (Appendix L)

244.47 (332)

Total delivered energy for all uses

$$(307) + (309) + (310) + (312) + (315) + (331) + (332) \dots (337b) = 2781.23 \quad (338)$$

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	443.06	x	4.24	x 0.01 =	18.79	(340a)
Water heating from boilers	1977.00	x	4.24	x 0.01 =	83.82	(342a)
Pumps and fans	116.69	x	13.19	x 0.01 =	15.39	(349)
Electricity for lighting	244.47	x	13.19	x 0.01 =	32.25	(350)
Additional standing charges					120.00	(351)
Total energy cost				(340a)...(342e) + (345)...(354) =	270.25	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.16	(357)
SAP value	83.86	
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) = 2703.98	x	0.216	=	584.06	(367)
Electrical energy for community heat distribution	24.20	x	0.519	=	12.56	(372)
Total CO ₂ associated with community systems					596.62	(373)
Total CO ₂ associated with space and water heating					596.62	(376)
Pumps and fans	116.69	x	0.519	=	60.56	(378)
Electricity for lighting	244.47	x	0.519	=	126.88	(379)
Total CO ₂ , kg/year				(376)..(382) =	784.06	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	14.77	(384)
EI value					89.29	
EI rating (section 14)					89	(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) = 2703.98	x	1.22	=	3298.86	(367)
Electrical energy for community heat distribution	24.20	x	3.07	=	74.30	(372)
Total primary energy associated with community systems					3373.15	(373)
Total primary energy associated with space and water heating					3373.15	(376)
Pumps and fans	116.69	x	3.07	=	358.23	(378)
Electricity for lighting	244.47	x	3.07	=	750.53	(379)
Primary energy kWh/year					4481.92	(383)
Dwelling primary energy rate kWh/m ² /year					84.41	(384)

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Assessor name	Mr AECOM Planner	Assessor number	101
Client	Default Client	Last modified	30/08/2018
Address	2.19 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	53.10 (1a) x	2.62 (2a) =	139.12 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 53.10 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	139.12 (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	2 x 10 =	20 (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) = 20 ÷ (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	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) = 0.31 (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	0.39	0.38	0.37	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.34	0.36
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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)
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d) natural ventilation or whole house positive input ventilation from loft

0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
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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			10.65	x 1.33	= 14.12		(27)						
External wall			8.95	x 0.18	= 1.61		(29a)						
Party wall			63.88	x 0.00	= 0.00		(32)						
Total area of external elements ΣA, m ²			19.60				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	15.73	(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						0.98	(36)						
Total fabric heat loss					(33) + (36) =	16.71	(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)	26.43	26.30	26.16	25.54	25.43	24.88	24.88	24.78	25.09	25.43	25.66	25.91	(38)
Heat transfer coefficient, W/K (37)m + (38)m	43.14	43.01	42.87	42.25	42.14	41.59	41.59	41.49	41.80	42.14	42.37	42.62	
	Average = Σ(39)1...12/12 =											42.25	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.81	0.81	0.81	0.80	0.79	0.78	0.78	0.78	0.79	0.79	0.80	0.80	
	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												1.78	(42)	
Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$												76.51	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$	84.16	81.10	78.04	74.98	71.92	68.86	68.86	71.92	74.98	78.04	81.10	84.16		
												$\Sigma(44)1...12 =$	918.13	(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)	124.81	109.16	112.64	98.20	94.23	81.31	75.35	86.46	87.50	101.97	111.31	120.87		
												$\Sigma(45)1...12 =$	1203.81	(45)
Distribution loss $0.15 \times (45)m$	18.72	16.37	16.90	14.73	14.13	12.20	11.30	12.97	13.12	15.30	16.70	18.13	(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 $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

174.05	153.64	161.89	145.86	143.47	128.97	124.59	135.71	135.15	151.21	158.96	170.11	(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

174.05	153.64	161.89	145.86	143.47	128.97	124.59	135.71	135.15	151.21	158.96	170.11	
$\Sigma(64)1...12 =$											1783.61	(64)

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

80.89	71.88	76.85	70.78	70.73	65.16	64.45	68.14	67.22	73.30	75.13	79.58	(65)
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5. Internal gains

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

Metabolic gains (Table 5)

89.08	89.08	89.08	89.08	89.08	89.08	89.08	89.08	89.08	89.08	89.08	89.08	(66)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

13.94	12.38	10.07	7.62	5.70	4.81	5.20	6.76	9.07	11.51	13.44	14.32	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

155.28	156.89	152.83	144.18	133.27	123.02	116.17	114.55	118.61	127.26	138.17	148.43	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

31.91	31.91	31.91	31.91	31.91	31.91	31.91	31.91	31.91	31.91	31.91	31.91	(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)

-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	-71.26	(71)
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Water heating gains (Table 5)

108.73	106.96	103.29	98.30	95.06	90.50	86.62	91.59	93.36	98.52	104.35	106.97	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

330.66	328.95	318.91	302.83	286.75	271.05	260.71	265.62	273.76	290.01	308.68	322.44	(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 x 10.65 x 19.64 x 0.9 x 0.63 x 0.70 = 63.92 (80)

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

63.92	125.05	205.94	300.35	368.09	376.81	358.74	308.15	239.52	148.38	79.71	52.57	(83)
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Total gains - internal and solar (73)m + (83)m

394.59	454.00	524.85	603.18	654.84	647.86	619.44	573.77	513.28	438.40	388.39	375.01	(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)

0.99	0.98	0.93	0.79	0.59	0.41	0.30	0.33	0.56	0.87	0.98	0.99	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

20.38	20.53	20.75	20.93	20.99	21.00	21.00	21.00	21.00	20.89	20.61	20.35	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.24	20.24	20.25	20.26	20.26	20.27	20.27	20.27	20.26	20.26	20.26	20.25	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.99	0.97	0.92	0.75	0.55	0.36	0.25	0.28	0.50	0.84	0.97	0.99	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

19.42	19.64	19.95	20.19	20.25	20.27	20.27	20.27	20.26	20.15	19.76	19.39	(90)
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Living area fraction

Living area ÷ (4) = 0.56 (91)

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

19.96	20.14	20.40	20.61	20.67	20.68	20.68	20.68	20.68	20.57	20.24	19.93	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.96	20.14	20.40	20.61	20.67	20.68	20.68	20.68	20.68	20.57	20.24	19.93	(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	0.97	0.92	0.77	0.57	0.39	0.27	0.31	0.53	0.85	0.97	0.99	(94)
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Useful gains, ηmGm, W (94)m x (84)m

390.04	441.43	482.29	465.50	374.11	252.67	169.72	177.62	273.12	373.94	377.58	371.73	(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]

675.68	655.60	595.91	494.73	377.89	252.91	169.74	177.66	274.87	420.07	556.58	670.44	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

212.51	143.92	84.53	21.05	2.81	0.00	0.00	0.00	0.00	34.32	128.88	222.24	(98)
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Σ(98)1...5, 10...12 = 850.26 (99)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 16.01 (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

227.29	153.93	90.41	22.51	3.01	0.00	0.00	0.00	0.00	36.70	137.84	237.69	(211)
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Σ(211)1...5, 10...12 = 909.37 (211)

Water heating

Efficiency of water heater

85.35	84.64	83.17	81.01	79.98	79.80	79.80	79.80	79.80	81.58	84.26	85.53	(217)
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Water heating fuel, kWh/month

203.93	181.52	194.64	180.05	179.38	161.61	156.13	170.06	169.36	185.34	188.65	198.90	(219)
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Σ(219a)1...12 = 2169.58 (219)

Annual totals

Space heating fuel - main system 1

909.37

Water heating fuel

2169.58

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)	246.12	(232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) = 3400.08	(238)

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

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	909.37	x	3.48	x 0.01 =	31.65	(240)
Water heating	2169.58	x	3.48	x 0.01 =	75.50	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	246.12	x	13.19	x 0.01 =	32.46	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	269.50	(255)

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

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.15	(257)
SAP value	83.90	
SAP rating (section 13)	84	(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	909.37	x	0.216	=	196.42	(261)
Water heating	2169.58	x	0.216	=	468.63	(264)
Space and water heating			(261) + (262) + (263) + (264) =		665.05	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	246.12	x	0.519	=	127.74	(268)
Total CO ₂ , kg/year				(265)...(271) =	831.72	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	15.66	(273)
EI value					88.64	
EI rating (section 14)					89	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	909.37	x	1.22	=	1109.44	(261)
Water heating	2169.58	x	1.22	=	2646.89	(264)
Space and water heating			(261) + (262) + (263) + (264) =		3756.33	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	246.12	x	3.07	=	755.60	(268)
Primary energy kWh/year					4742.17	(272)
Dwelling primary energy rate kWh/m ² /year					89.31	(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	4.1 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	98.80 (1a) x	2.62 (2a) =	258.86 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 98.80 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	258.86 (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	1 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.93 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.14 (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	0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
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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]

0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28
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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			26.79	1.33	35.52		(27)						
External wall			91.05	0.18	16.39		(29a)						
Party wall			40.39	0.00	0.00		(32)						
Total area of external elements ΣA, m ²			117.84				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	51.91	(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						17.68	(36)						
Total fabric heat loss					(33) + (36) =	69.58	(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)	25.15	24.85	24.56	23.07	22.78	21.30	21.30	21.00	21.89	22.78	23.37	23.96	(38)
Heat transfer coefficient, W/K (37)m + (38)m	94.73	94.43	94.14	92.66	92.36	90.88	90.88	90.58	91.47	92.36	92.95	93.55	
	Average = Σ(39)1...12/12 =											92.58	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.96	0.96	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.95	
	Average = Σ(40)1...12/12 =											0.94	(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												2.73	(42)	
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												98.99	(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)														
	108.89	104.93	100.97	97.01	93.05	89.09	89.09	93.05	97.01	100.97	104.93	108.89		
												Σ(44)1...12 =	1187.92	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)														
	161.48	141.24	145.74	127.06	121.92	105.21	97.49	111.87	113.21	131.93	144.01	156.39		
												Σ(45)1...12 =	1557.55	(45)
Distribution loss 0.15 x (45)m														
	24.22	21.19	21.86	19.06	18.29	15.78	14.62	16.78	16.98	19.79	21.60	23.46	(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 $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

219.16	193.33	203.41	182.87	179.59	161.02	155.16	169.54	169.02	189.60	199.83	214.06	(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) $(62)m + (63)m$

219.16	193.33	203.41	182.87	179.59	161.02	155.16	169.54	169.02	189.60	199.83	214.06	
$\Sigma(64)1...12 =$											2236.59	(64)

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

99.83	88.63	94.60	86.90	86.68	79.63	78.55	83.33	82.29	90.01	92.53	98.14	(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)

136.41	136.41	136.41	136.41	136.41	136.41	136.41	136.41	136.41	136.41	136.41	136.41	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

22.68	20.14	16.38	12.40	9.27	7.83	8.46	10.99	14.75	18.73	21.86	23.31	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

254.37	257.01	250.36	236.20	218.32	201.52	190.30	187.66	194.31	208.47	226.35	243.15	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

36.64	36.64	36.64	36.64	36.64	36.64	36.64	36.64	36.64	36.64	36.64	36.64	(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)

-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	(71)
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Water heating gains (Table 5)

134.18	131.90	127.15	120.69	116.50	110.60	105.58	112.01	114.29	120.97	128.52	131.90	(72)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

475.15	472.97	457.81	433.21	408.02	383.87	368.26	374.58	387.28	412.10	440.65	462.28	(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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North $0.77 \times 6.27 \times 10.63 \times 0.9 \times 0.45 \times 0.80 = 16.63$ (74)

West $0.77 \times 20.52 \times 19.64 \times 0.9 \times 0.45 \times 0.80 = 100.54$ (80)

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

117.18	228.47	377.93	559.17	695.83	717.78	681.06	577.35	441.67	271.22	145.89	96.55	(83)
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Total gains - internal and solar $(73)m + (83)m$

592.33	701.45	835.74	992.39	1103.85	1101.65	1049.32	951.94	828.95	683.33	586.54	558.83	(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)
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.96	0.94	0.89	0.79	0.65	0.49	0.37	0.42	0.64	0.86	0.95	0.97	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

19.04	19.33	19.80	20.35	20.72	20.91	20.97	20.96	20.80	20.27	19.56	19.00	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.12	20.12	20.12	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.13	20.13
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(88)

Utilisation factor for gains for rest of dwelling n2,m

0.96	0.93	0.88	0.77	0.61	0.43	0.30	0.35	0.58	0.83	0.94	0.96
------	------	------	------	------	------	------	------	------	------	------	------

(89)

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

17.48	17.90	18.57	19.33	19.83	20.07	20.13	20.12	19.95	19.25	18.24	17.42
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(90)

Living area fraction

Living area ÷ (4) = 0.43 (91)

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

18.15	18.52	19.10	19.77	20.21	20.44	20.50	20.49	20.32	19.69	18.81	18.10
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(92)

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

18.15	18.52	19.10	19.77	20.21	20.44	20.50	20.49	20.32	19.69	18.81	18.10
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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	0.75	0.61	0.45	0.33	0.37	0.60	0.82	0.92	0.95
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(94)

Useful gains, ηmGm, W (94)m x (84)m

559.33	642.27	718.05	748.18	675.25	498.28	344.99	356.74	494.73	560.29	539.34	531.61
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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]

1312.41	1286.03	1185.96	1007.19	786.33	530.38	353.99	370.08	568.82	839.56	1088.67	1300.30
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(97)

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

560.29	432.61	348.13	186.49	82.64	0.00	0.00	0.00	0.00	207.77	395.52	571.90
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Σ(98)1...5, 10...12 = 2785.35 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 28.19 (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

2785.35 (98)

Space heat from boilers

(98) x (304a) x (305) x (306) = 2924.62 (307a)

Water heating

Annual water heating requirement

2236.59 (64)

Water heat from boilers

(64) x (303a) x (305a) x (306) = 2348.42 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 52.73 (313)

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

217.12 (330a)

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

Total electricity for the above, kWh/year

217.12 (331)

Electricity for lighting (Appendix L)

400.49 (332)

Total delivered energy for all uses

(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 5890.65 (338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	2924.62	x	4.24	x 0.01 =	124.00	(340a)
Water heating from boilers	2348.42	x	4.24	x 0.01 =	99.57	(342a)
Pumps and fans	217.12	x	13.19	x 0.01 =	28.64	(349)
Electricity for lighting	400.49	x	13.19	x 0.01 =	52.82	(350)
Additional standing charges					120.00	(351)
Total energy cost				(340a)...(342e) + (345)...(354) =	425.04	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.24	(357)
SAP value	82.68	
SAP rating (section 13)	83	(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) =	5891.67	x	0.216	=	1272.60	(367)
Electrical energy for community heat distribution	52.73	x	0.519	=	27.37	(372)
Total CO ₂ associated with community systems					1299.97	(373)
Total CO ₂ associated with space and water heating					1299.97	(376)
Pumps and fans	217.12	x	0.519	=	112.68	(378)
Electricity for lighting	400.49	x	0.519	=	207.86	(379)
Total CO ₂ , kg/year				(376)...(382) =	1620.51	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	16.40	(384)
EI value					84.90	
EI rating (section 14)					85	(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) =	5891.67	x	1.22	=	7187.83	(367)
Electrical energy for community heat distribution	52.73	x	3.07	=	161.88	(372)
Total primary energy associated with community systems					7349.72	(373)
Total primary energy associated with space and water heating					7349.72	(376)
Pumps and fans	217.12	x	3.07	=	666.54	(378)
Electricity for lighting	400.49	x	3.07	=	1229.51	(379)
Primary energy kWh/year					9245.77	(383)
Dwelling primary energy rate kWh/m ² /year					93.58	(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	4.1 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	98.80 (1a) x	2.62 (2a) =	258.86 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 98.80 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	258.86 (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	1 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.93 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.34 (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	0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.40
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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)
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d) natural ventilation or whole house positive input ventilation from loft

	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	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	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	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			24.71	1.33	32.76		(27)						
External wall			93.13	0.18	16.76		(29a)						
Party wall			40.39	0.00	0.00		(32)						
Total area of external elements ΣA, m ²			117.84				(31)						
Fabric heat loss, W/K = Σ(A × U)					(26)...(30) + (32) =	49.52	(33)						
Heat capacity Cm = Σ(A × 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 × Ψ) calculated using Appendix K						5.89	(36)						
Total fabric heat loss					(33) + (36) =	55.41	(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)	50.66	50.36	50.05	48.63	48.37	47.13	47.13	46.90	47.60	48.37	48.90	49.47	(38)
Heat transfer coefficient, W/K (37)m + (38)m	106.08	105.77	105.47	104.05	103.78	102.54	102.54	102.31	103.02	103.78	104.32	104.88	
	Average = Σ(39)1...12/12 =											104.04	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.07	1.07	1.07	1.05	1.05	1.04	1.04	1.04	1.04	1.05	1.06	1.06	
	Average = Σ(40)1...12/12 =											1.05	(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												2.73	(42)
Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$												98.99	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$	108.89	104.93	100.97	97.01	93.05	89.09	89.09	93.05	97.01	100.97	104.93	108.89	
	$\Sigma(44)_{1...12} =$											1187.92	(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)	161.48	141.24	145.74	127.06	121.92	105.21	97.49	111.87	113.21	131.93	144.01	156.39	
	$\Sigma(45)_{1...12} =$											1557.55	(45)
Distribution loss $0.15 \times (45)m$	24.22	21.19	21.86	19.06	18.29	15.78	14.62	16.78	16.98	19.79	21.60	23.46	(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 $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

210.73	185.71	194.98	174.72	171.16	152.86	146.73	161.11	160.86	181.17	191.67	205.63	(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) $(62)m + (63)m$

210.73	185.71	194.98	174.72	171.16	152.86	146.73	161.11	160.86	181.17	191.67	205.63	
$\Sigma(64)1...12 =$											2137.34	(64)

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

93.09	82.54	87.85	80.37	79.93	73.10	71.81	76.59	75.76	83.26	86.01	91.39	(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)

136.41	136.41	136.41	136.41	136.41	136.41	136.41	136.41	136.41	136.41	136.41	136.41	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

22.68	20.14	16.38	12.40	9.27	7.83	8.46	10.99	14.75	18.73	21.86	23.31	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

254.37	257.01	250.36	236.20	218.32	201.52	190.30	187.66	194.31	208.47	226.35	243.15	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

36.64	36.64	36.64	36.64	36.64	36.64	36.64	36.64	36.64	36.64	36.64	36.64	(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)

-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	-109.13	(71)
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Water heating gains (Table 5)

125.12	122.83	118.08	111.63	107.44	101.53	96.52	102.94	105.23	111.91	119.46	122.84	(72)
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Total internal gains $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$

469.09	466.91	451.75	427.15	401.95	377.81	362.20	368.52	381.22	406.04	434.59	456.22	(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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North $0.77 \times 5.79 \times 10.63 \times 0.9 \times 0.63 \times 0.70 = 18.82$ (74)

West $0.77 \times 18.92 \times 19.64 \times 0.9 \times 0.63 \times 0.70 = 113.56$ (80)

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

132.38	258.11	426.96	631.73	786.13	810.94	769.44	652.27	498.97	306.41	164.81	109.08	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

601.47	725.02	878.71	1058.88	1188.09	1188.75	1131.64	1020.79	880.19	712.45	599.40	565.30	(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)
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Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.98	0.91	0.75	0.54	0.40	0.46	0.74	0.96	0.99	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

19.87	20.05	20.35	20.71	20.92	20.99	21.00	21.00	20.94	20.62	20.17	19.84	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.02	20.02	20.03	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.04	20.03
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.97	0.88	0.69	0.47	0.31	0.37	0.66	0.94	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

 (89)

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

18.51	18.78	19.22	19.72	19.97	20.05	20.05	20.05	20.01	19.61	18.97	18.48
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 (90)

Living area fraction

Living area ÷ (4) = 0.43 (91)

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

19.10	19.33	19.71	20.15	20.38	20.45	20.46	20.46	20.41	20.04	19.49	19.07
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

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

19.10	19.33	19.71	20.15	20.38	20.45	20.46	20.46	20.41	20.04	19.49	19.07
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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

1.00	0.99	0.97	0.88	0.71	0.50	0.35	0.41	0.70	0.94	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

 (94)

Useful gains, ηmGm, W (94)m x (84)m

599.19	717.72	849.37	934.49	842.28	592.92	395.00	413.58	612.10	672.59	594.23	563.73
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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]

1569.99	1526.27	1392.85	1170.06	901.08	600.12	395.83	415.39	650.24	979.99	1292.41	1559.48
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 (97)

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

722.27	543.34	404.35	169.60	43.75	0.00	0.00	0.00	0.00	228.70	502.69	740.84
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Σ(98)1...5, 10...12 = 3355.55 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 33.96 (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

772.48	581.11	432.46	181.39	46.79	0.00	0.00	0.00	0.00	244.60	537.64	792.34
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Σ(211)1...5, 10...12 = 3588.82 (211)

Water heating

Efficiency of water heater

87.84	87.51	86.72	84.73	81.77	79.80	79.80	79.80	79.80	85.44	87.27	87.94
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 (217)

Water heating fuel, kWh/month

239.90	212.22	224.85	206.19	209.33	191.55	183.87	201.90	201.58	212.06	219.63	233.84
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Σ(219a)1...12 = 2536.91 (219)

Annual totals

Space heating fuel - main system 1

3588.82

Water heating fuel

2536.91

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)

400.49

(232)

Total delivered energy for all uses

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

6601.22

(238)

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

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3588.82	x	3.48	x 0.01 =	124.89	(240)
Water heating	2536.91	x	3.48	x 0.01 =	88.28	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	400.49	x	13.19	x 0.01 =	52.82	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	395.89	(255)

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

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.16	(257)
SAP value	83.87	
SAP rating (section 13)	84	(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	3588.82	x	0.216	=	775.19	(261)
Water heating	2536.91	x	0.216	=	547.97	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1323.16	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	400.49	x	0.519	=	207.86	(268)
Total CO ₂ , kg/year				(265)...(271) =	1569.94	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	15.89	(273)
EI value					85.37	
EI rating (section 14)					85	(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	3588.82	x	1.22	=	4378.36	(261)
Water heating	2536.91	x	1.22	=	3095.03	(264)
Space and water heating				(261) + (262) + (263) + (264) =	7473.39	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	400.49	x	3.07	=	1229.51	(268)
Primary energy kWh/year					8933.15	(272)
Dwelling primary energy rate kWh/m ² /year					90.42	(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	4.1 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	123.47 (1a) x	2.62 (2a) =	323.49 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 123.47 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	323.49 (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	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	1 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.93 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.14 (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	0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16 (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)
--	--

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

	0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28 (24a)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

	0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28 (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			37.21	1.33	49.33		(27)						
External wall			64.05	0.18	11.53		(29a)						
Party wall			52.32	0.00	0.00		(32)						
Total area of external elements ΣA, m ²			101.26				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	60.86	(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						15.19	(36)						
Total fabric heat loss					(33) + (36) =	76.05	(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)	31.43	31.06	30.69	28.84	28.47	26.61	26.61	26.24	27.36	28.47	29.21	29.95	(38)
Heat transfer coefficient, W/K (37)m + (38)m	107.48	107.11	106.74	104.89	104.52	102.66	102.66	102.29	103.40	104.52	105.26	106.00	
	Average = Σ(39)1...12/12 =											104.79	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.87	0.87	0.86	0.85	0.85	0.83	0.83	0.83	0.84	0.85	0.85	0.86	
	Average = Σ(40)1...12/12 =											0.85	(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												2.88	(42)	
Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$												102.50	(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)														
	112.75	108.65	104.55	100.45	96.35	92.25	92.25	96.35	100.45	104.55	108.65	112.75		
												$\Sigma(44)1...12 =$	1230.00	(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)														
	167.20	146.24	150.90	131.56	126.24	108.93	100.94	115.83	117.22	136.60	149.11	161.93		
												$\Sigma(45)1...12 =$	1612.72	(45)
Distribution loss $0.15 \times (45)m$														
	25.08	21.94	22.64	19.73	18.94	16.34	15.14	17.37	17.58	20.49	22.37	24.29	(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 $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

224.88	198.33	208.58	187.37	183.91	164.75	158.62	173.51	173.03	194.28	204.93	219.60	(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

224.88	198.33	208.58	187.37	183.91	164.75	158.62	173.51	173.03	194.28	204.93	219.60	
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$$\Sigma(64)1...12 = 2291.77 \quad (64)$$

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

101.73	90.30	96.31	88.39	88.11	80.87	79.70	84.65	83.62	91.56	94.23	99.98	(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)

143.79	143.79	143.79	143.79	143.79	143.79	143.79	143.79	143.79	143.79	143.79	143.79	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

25.82	22.94	18.65	14.12	10.56	8.91	9.63	12.52	16.80	21.33	24.90	26.54	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

289.66	292.67	285.10	268.97	248.62	229.48	216.70	213.70	221.27	237.40	257.75	276.88	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

37.38	37.38	37.38	37.38	37.38	37.38	37.38	37.38	37.38	37.38	37.38	37.38	(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)
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Losses e.g. evaporation (Table 5)

-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	(71)
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Water heating gains (Table 5)

136.74	134.37	129.45	122.77	118.43	112.32	107.13	113.78	116.14	123.06	130.88	134.38	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

518.36	516.11	499.34	472.00	443.74	416.85	399.60	406.13	420.35	447.93	479.66	503.94	(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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East $0.77 \times 25.19 \times 19.64 \times 0.9 \times 0.45 \times 0.80 = 123.43 \quad (76)$

North $0.77 \times 7.46 \times 10.63 \times 0.9 \times 0.45 \times 0.80 = 19.79 \quad (74)$

South $0.77 \times 4.56 \times 46.75 \times 0.9 \times 0.45 \times 0.80 = 53.19 \quad (78)$

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

196.40	366.38	572.86	808.56	980.46	1002.17	954.52	824.58	655.64	425.47	241.36	163.96	(83)
--------	--------	--------	--------	--------	---------	--------	--------	--------	--------	--------	--------	------

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

714.77	882.49	1072.20	1280.56	1424.19	1419.03	1354.11	1230.71	1075.99	873.40	721.02	667.90	(84)
--------	--------	---------	---------	---------	---------	---------	---------	---------	--------	--------	--------	------

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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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

0.97	0.94	0.88	0.76	0.60	0.44	0.33	0.37	0.59	0.84	0.94	0.97	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

19.23	19.56	20.02	20.52	20.81	20.95	20.99	20.98	20.87	20.42	19.74	19.18	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

20.19	20.20	20.20	20.21	20.21	20.23	20.23	20.23	20.22	20.21	20.21	20.20	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

0.96	0.93	0.86	0.73	0.56	0.39	0.27	0.31	0.54	0.81	0.93	0.97	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

17.80	18.27	18.93	19.62	20.01	20.18	20.22	20.21	20.09	19.51	18.54	17.73	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

$$\text{Living area} \div (4) = 0.54 \quad (91)$$

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

18.57	18.97	19.52	20.10	20.44	20.60	20.63	20.63	20.52	20.00	19.19	18.51	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

18.57	18.97	19.52	20.10	20.44	20.60	20.63	20.63	20.52	20.00	19.19	18.51	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.95	0.91	0.85	0.73	0.58	0.42	0.30	0.34	0.56	0.80	0.92	0.96	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

678.15	805.72	907.54	931.11	819.55	591.34	407.60	422.71	601.46	702.29	664.13	638.89	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

1533.75	1506.64	1389.74	1175.09	913.87	615.58	413.91	432.33	663.36	982.96	1272.19	1516.89	(97)
---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

636.56	471.01	358.75	175.66	70.17	0.00	0.00	0.00	0.00	208.81	437.80	653.23	(98)
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------	------

$$\sum(98)1...5, 10...12 = 3012.02 \quad (98)$$

Space heating requirement kWh/m²/year

$$(98) \div (4) = 24.39 \quad (99)$$

9b. Energy requirements - community heating scheme

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

$$'0' \text{ if none } = 0.00 \quad (301)$$

Fraction of space heat from community system

$$1 - (301) = 1.00 \quad (302)$$

Fraction of community heat from boilers

$$= 1.00 \quad (303a)$$

Fraction of total space heat from community boilers

$$(302) \times (303a) = 1.00 \quad (304a)$$

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

$$= 1.00 \quad (305)$$

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

$$= 1.00 \quad (305a)$$

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

$$= 1.05 \quad (306)$$

Space heating

Annual space heating requirement

$$3012.02 \quad (98)$$

Space heat from boilers

$$(98) \times (304a) \times (305) \times (306) = 3162.62 \quad (307a)$$

Water heating

Annual water heating requirement

$$2291.77 \quad (64)$$

Water heat from boilers

$$(64) \times (303a) \times (305a) \times (306) = 2406.36 \quad (310a)$$

Electricity used for heat distribution

$$0.01 \times [(307a)...(307e) + (310a)...(310e)] = 55.69 \quad (313)$$

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

$$\text{mechanical ventilation fans - balanced, extract or positive input from outside} = 271.33 \quad (330a)$$

Total electricity for the above, kWh/year		271.33	(331)
Electricity for lighting (Appendix L)		456.06	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =	6296.36	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	3162.62	x	4.24	x 0.01 =	134.09	(340a)
Water heating from boilers	2406.36	x	4.24	x 0.01 =	102.03	(342a)
Pumps and fans	271.33	x	13.19	x 0.01 =	35.79	(349)
Electricity for lighting	456.06	x	13.19	x 0.01 =	60.15	(350)
Additional standing charges					120.00	(351)
Total energy cost				(340a)...(342e) + (345)...(354) =	452.07	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.13	(357)
SAP value	84.28	
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) =	6222.31	x	0.216	=	1344.02 (367)
Electrical energy for community heat distribution	55.69	x	0.519	=	28.90	(372)
Total CO ₂ associated with community systems					1372.92	(373)
Total CO ₂ associated with space and water heating					1372.92	(376)
Pumps and fans	271.33	x	0.519	=	140.82	(378)
Electricity for lighting	456.06	x	0.519	=	236.69	(379)
Total CO ₂ , kg/year				(376)...(382) =	1750.44	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	14.18	(384)
EI value					86.08	
EI rating (section 14)					86	(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) =	6222.31	x	1.22	=	7591.22 (367)
Electrical energy for community heat distribution	55.69	x	3.07	=	170.97	(372)
Total primary energy associated with community systems					7762.19	(373)
Total primary energy associated with space and water heating					7762.19	(376)
Pumps and fans	271.33	x	3.07	=	832.98	(378)
Electricity for lighting	456.06	x	3.07	=	1400.09	(379)
Primary energy kWh/year					9995.26	(383)



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	4.1 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	123.47 (1a)	2.62 (2a)	323.49 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 123.47 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) = 323.49 (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	4 x 10 =	40 (7a)
Number of passive vents	0 x 10 =	0 (7b)
Number of flueless gas fires	0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = 40 ÷ (5) = 0.12 (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)
--	--

Number of sides on which the dwelling is sheltered	1 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.93 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.35 (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	0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41
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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	0.60	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.60	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	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			30.87	1.33	40.93		(27)						
External wall			70.39	0.18	12.67		(29a)						
Party wall			52.32	0.00	0.00		(32)						
Total area of external elements ΣA, m ²			101.26				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	53.60	(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						5.06	(36)						
Total fabric heat loss					(33) + (36) =	58.66	(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)	63.74	63.34	62.94	61.09	60.74	59.13	59.13	58.83	59.75	60.74	61.45	62.18	(38)
Heat transfer coefficient, W/K (37)m + (38)m	122.40	122.00	121.60	119.75	119.40	117.79	117.79	117.49	118.41	119.40	120.11	120.84	
	Average = Σ(39)1...12/12 =											119.75	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.99	0.99	0.98	0.97	0.97	0.95	0.95	0.95	0.96	0.97	0.97	0.98	
	Average = Σ(40)1...12/12 =											0.97	(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

2.88

(42)

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

102.50

(43)

JanFebMarAprMayJunJulAugSepOctNovDec

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

112.75108.65104.55100.4596.3592.2592.2596.35100.45104.55108.65112.75

$\Sigma(44)1...12 =$

1230.00

(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)

167.20146.24150.90131.56126.24108.93100.94115.83117.22136.60149.11161.93

$\Sigma(45)1...12 =$

1612.72

(45)

Distribution loss $0.15 \times (45)m$

25.0821.9422.6419.7318.9416.3415.1417.3717.5820.4922.3724.29

(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 $(55) \times (41)m$

25.9823.4725.9825.1425.9825.1425.9825.9825.1425.9825.1425.98

(56)

If the vessel contains dedicated solar storage or dedicated WWHRs $(56)m \times [(47) - V_s] \div (47)$, else (56)

25.9823.4725.9825.1425.9825.1425.9825.9825.1425.9825.1425.98

(57)

Primary circuit loss for each month from Table 3

23.2621.0123.2622.5123.2622.5123.2623.2622.5123.2622.5123.26

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

216.45	190.72	200.15	179.22	175.48	156.59	150.19	165.08	164.87	185.85	196.77	211.17	(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)
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Output from water heater for each month (kWh/month) (62)m + (63)m

216.45	190.72	200.15	179.22	175.48	156.59	150.19	165.08	164.87	185.85	196.77	211.17	
$\Sigma(64)1...12 =$											2192.51	(64)

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

94.99	84.21	89.57	81.87	81.37	74.34	72.96	77.91	77.10	84.82	87.70	93.24	(65)
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5. Internal gains

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

Metabolic gains (Table 5)

143.79	143.79	143.79	143.79	143.79	143.79	143.79	143.79	143.79	143.79	143.79	143.79	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

25.82	22.94	18.65	14.12	10.56	8.91	9.63	12.52	16.80	21.33	24.90	26.54	(67)
-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------

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

289.66	292.67	285.10	268.97	248.62	229.48	216.70	213.70	221.27	237.40	257.75	276.88	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

37.38	37.38	37.38	37.38	37.38	37.38	37.38	37.38	37.38	37.38	37.38	37.38	(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)

-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	-115.03	(71)
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Water heating gains (Table 5)

127.67	125.31	120.39	113.71	109.37	103.26	98.06	104.72	107.08	114.00	121.81	125.32	(72)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

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

512.30	510.05	493.28	465.93	437.67	410.79	393.53	400.07	414.29	441.86	473.60	497.88	(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 20.90 x 19.64 x 0.9 x 0.63 x 0.70 = 125.45 (76)

North 0.77 x 6.19 x 10.63 x 0.9 x 0.63 x 0.70 = 20.12 (74)

South 0.77 x 3.78 x 46.75 x 0.9 x 0.63 x 0.70 = 54.01 (78)

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

199.57	372.30	582.14	821.69	996.40	1018.48	970.04	837.98	666.28	432.36	245.25	166.60	(83)
--------	--------	--------	--------	--------	---------	--------	--------	--------	--------	--------	--------	------

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

711.87	882.35	1075.42	1287.63	1434.08	1429.27	1363.58	1238.05	1080.57	874.22	718.85	664.48	(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)

1.00	0.99	0.98	0.90	0.73	0.52	0.38	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)

19.96	20.15	20.44	20.77	20.95	20.99	21.00	21.00	20.96	20.68	20.25	19.93	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

20.09	20.09	20.10	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.11	20.10	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.97	0.87	0.67	0.45	0.30	0.35	0.64	0.94	0.99	1.00	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

18.69	18.97	19.39	19.85	20.06	20.12	20.12	20.12	20.09	19.75	19.13	18.65	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = 0.54 (91)

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

19.37	19.61	19.96	20.35	20.54	20.59	20.60	20.60	20.56	20.25	19.74	19.34	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

19.37	19.61	19.96	20.35	20.54	20.59	20.60	20.60	20.56	20.25	19.74	19.34	(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	0.70	0.49	0.34	0.40	0.68	0.94	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

709.89	874.35	1039.61	1130.12	1001.44	699.84	470.02	491.61	732.21	823.86	713.70	663.20	(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]

1844.90	1794.16	1636.60	1370.85	1055.45	705.63	470.63	492.96	765.24	1152.50	1517.54	1829.72	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

844.44	618.12	444.16	173.32	40.19	0.00	0.00	0.00	0.00	244.51	578.76	867.89	
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Σ(98)1...5, 10...12 = 3811.39 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) 30.87 (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

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

903.15	661.09	475.04	185.37	42.98	0.00	0.00	0.00	0.00	261.51	619.00	928.22	
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Σ(211)1...5, 10...12 = 4076.35 (211)

Water heating

Efficiency of water heater

88.09	87.73	86.88	84.72	81.60	79.80	79.80	79.80	79.80	85.55	87.52	88.19	(217)
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Water heating fuel, kWh/month

245.71	217.40	230.37	211.53	215.06	196.22	188.20	206.86	206.60	217.25	224.82	239.46	
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Σ(219a)1...12 = 2599.49 (219)

Annual totals

Space heating fuel - main system 1

4076.35

Water heating fuel		2599.49	
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)		456.06	(232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) =	7206.90	(238)

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

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	4076.35	x	3.48	x 0.01 =	141.86	(240)
Water heating	2599.49	x	3.48	x 0.01 =	90.46	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	456.06	x	13.19	x 0.01 =	60.15	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)...(242) + (245)...(254) =		422.37	(255)

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

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.05	(257)
SAP value	85.31	
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	4076.35	x	0.216	=	880.49	(261)
Water heating	2599.49	x	0.216	=	561.49	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1441.98	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	456.06	x	0.519	=	236.69	(268)
Total CO ₂ , kg/year			(265)...(271) =		1717.60	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		13.91	(273)
EI value					86.34	
EI rating (section 14)					86	(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	4076.35	x	1.22	=	4973.15	(261)
Water heating	2599.49	x	1.22	=	3171.37	(264)
Space and water heating			(261) + (262) + (263) + (264) =		8144.52	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	456.06	x	3.07	=	1400.09	(268)
Primary energy kWh/year					9774.87	(272)
Dwelling primary energy rate kWh/m ² /year					79.17	(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	5.3 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	103.20 (1a) x	2.62 (2a) =	270.38 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 103.20 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	270.38 (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	1 (19)
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Shelter factor	1 - [0.075 x (19)] = 0.93 (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = 0.14 (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

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
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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)
--	--

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

0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28
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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			44.28	x 1.33	= 58.70		(27)						
External wall			35.72	x 0.18	= 6.43		(29a)						
Party wall			51.42	x 0.00	= 0.00		(32)						
Roof			103.20	x 0.12	= 12.38		(30)						
Total area of external elements ΣA, m ²			183.20				(31)						
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	77.52 (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							27.48 (36)						
Total fabric heat loss						(33) + (36) =	105.00 (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)	26.27	25.96	25.65	24.10	23.79	22.25	22.25	21.94	22.86	23.79	24.41	25.03	(38)
Heat transfer coefficient, W/K (37)m + (38)m	131.27	130.96	130.65	129.10	128.79	127.24	127.24	126.93	127.86	128.79	129.41	130.03	
	Average = Σ(39)1...12/12 =											129.02 (39)	
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.27	1.27	1.27	1.25	1.25	1.23	1.23	1.23	1.24	1.25	1.25	1.26	
	Average = Σ(40)1...12/12 =											1.25 (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

2.77 (42)

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

99.92 (43)

JanFebMarAprMayJunJulAugSepOctNovDec

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

109.91105.92101.9297.9293.9389.9389.9393.9397.92101.92105.92109.91

$\Sigma(44)_{1...12} =$ 1199.06 (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)

163.00142.56147.11128.25123.06106.1998.40112.92114.27133.17145.36157.86

$\Sigma(45)_{1...12} =$ 1572.16 (45)

Distribution loss $0.15 \times (45)m$

24.4521.3822.0719.2418.4615.9314.7616.9417.1419.9821.8023.68 (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 $(55) \times (41)m$

34.4131.0834.4133.3034.4133.3034.4134.4133.3034.4133.3034.41 (56)

If the vessel contains dedicated solar storage or dedicated WWHRS $(56)m \times [(47) - V_s] \div (47)$, else (56)

34.4131.0834.4133.3034.4133.3034.4134.4133.3034.4133.3034.41 (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)
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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 $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

220.67	194.65	204.78	184.07	180.73	162.01	156.08	170.59	170.08	190.84	201.18	215.53	(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

220.67	194.65	204.78	184.07	180.73	162.01	156.08	170.59	170.08	190.84	201.18	215.53	
$\Sigma(64)1...12 =$											2251.21	(64)

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

100.34	89.07	95.05	87.29	87.06	79.96	78.86	83.68	82.64	90.42	92.98	98.63	(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)

138.36	138.36	138.36	138.36	138.36	138.36	138.36	138.36	138.36	138.36	138.36	138.36	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

23.30	20.70	16.83	12.74	9.53	8.04	8.69	11.30	15.16	19.25	22.47	23.95	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

261.40	264.11	257.28	242.72	224.36	207.09	195.56	192.85	199.68	214.23	232.60	249.87	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	(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)
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Losses e.g. evaporation (Table 5)

-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	(71)
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Water heating gains (Table 5)

134.86	132.55	127.76	121.24	117.01	111.05	105.99	112.48	114.78	121.53	129.14	132.56	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

484.07	481.87	466.38	441.22	415.40	390.70	374.75	381.13	394.13	419.52	448.72	470.89	(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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East	0.77	x	31.80	x	19.64	x	0.9	x	0.45	x	0.80	=	155.82	(76)
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North	0.77	x	10.14	x	10.63	x	0.9	x	0.45	x	0.80	=	26.90	(74)
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South	0.77	x	2.34	x	46.75	x	0.9	x	0.45	x	0.80	=	27.29	(78)
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Solar gains in watts $\Sigma(74)m...(82)m$

210.01	400.91	646.27	936.76	1153.29	1185.34	1126.38	962.22	748.32	471.08	259.82	174.14	(83)
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Total gains - internal and solar (73)m + (83)m

694.08	882.78	1112.64	1377.98	1568.69	1576.03	1501.13	1343.35	1142.46	890.60	708.54	645.03	(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
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.96	0.93	0.87	0.76	0.61	0.46	0.35	0.40	0.62	0.84	0.94	0.96	(85)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.46	18.86	19.45	20.13	20.60	20.86	20.95	20.93	20.70	20.01	19.10	18.39	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

19.86	19.87	19.87	19.88	19.88	19.89	19.89	19.90	19.89	19.88	19.88	19.87	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.95	0.92	0.85	0.72	0.56	0.40	0.27	0.32	0.55	0.81	0.93	0.96	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

16.50	17.07	17.91	18.85	19.46	19.77	19.86	19.85	19.61	18.72	17.44	16.41	(90)
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Living area fraction

Living area ÷ (4) = (91)

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

17.43	17.92	18.64	19.46	20.00	20.29	20.38	20.36	20.13	19.33	18.23	17.35	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.43	17.92	18.64	19.46	20.00	20.29	20.38	20.36	20.13	19.33	18.23	17.35	(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

0.93	0.89	0.82	0.71	0.57	0.42	0.31	0.35	0.56	0.79	0.90	0.94	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

647.69	788.75	916.56	976.57	890.98	664.13	461.46	475.10	645.11	703.96	640.64	607.60	(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]

1723.94	1704.51	1586.63	1362.73	1069.30	723.93	480.75	502.80	770.89	1124.39	1440.08	1709.95	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

800.73	615.39	498.53	278.04	132.67	0.00	0.00	0.00	0.00	312.80	575.59	820.15	(98)
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Σ(98)1...5, 10...12 = (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

9b. Energy requirements - community heating scheme

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

'0' if none (301)

Fraction of space heat from community system

1 - (301) = (302)

Fraction of community heat from boilers

(303a)

Fraction of total space heat from community boilers

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

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

(305)

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

(305a)

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

(306)

Space heating

Annual space heating requirement

(98)

Space heat from boilers

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

Water heating

Annual water heating requirement

(64)

Water heat from boilers

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

Electricity used for heat distribution

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

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

mechanical ventilation fans - balanced, extract or positive input from outside	226.78	(330a)
Total electricity for the above, kWh/year	226.78	(331)
Electricity for lighting (Appendix L)	411.56	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 7237.70	(338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	4235.59	x	4.24	x 0.01 =	179.59	(340a)
Water heating from boilers	2363.77	x	4.24	x 0.01 =	100.22	(342a)
Pumps and fans	226.78	x	13.19	x 0.01 =	29.91	(349)
Electricity for lighting	411.56	x	13.19	x 0.01 =	54.28	(350)
Additional standing charges					120.00	(351)
Total energy cost				(340a)...(342e) + (345)...(354) =	484.01	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.37	(357)
SAP value	80.86	
SAP rating (section 13)	81	(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) = 7373.59	x	0.216	=	1592.69	(367)
Electrical energy for community heat distribution	65.99	x	0.519	=	34.25	(372)
Total CO ₂ associated with community systems					1626.95	(373)
Total CO ₂ associated with space and water heating					1626.95	(376)
Pumps and fans	226.78	x	0.519	=	117.70	(378)
Electricity for lighting	411.56	x	0.519	=	213.60	(379)
Total CO ₂ , kg/year				(376)...(382) =	1958.24	(383)
Dwelling CO ₂ emission rate				(383) ÷ (4) =	18.98	(384)
EI value					82.29	
EI rating (section 14)					82	(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) = 7373.59	x	1.22	=	8995.78	(367)
Electrical energy for community heat distribution	65.99	x	3.07	=	202.60	(372)
Total primary energy associated with community systems					9198.38	(373)
Total primary energy associated with space and water heating					9198.38	(376)
Pumps and fans	226.78	x	3.07	=	696.23	(378)
Electricity for lighting	411.56	x	3.07	=	1263.47	(379)

Primary energy kWh/year

11158.08	(383)
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Dwelling primary energy rate kWh/m2/year

108.12	(384)
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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
 Client Default Client
 Address 5.3 redYellow 42, London

Assessor number 101
 Last modified 30/08/2018

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	103.20 (1a)	2.62 (2a)	270.38 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 103.20 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	270.38 (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	4	40 (7a)
Number of passive vents	0	0 (7b)
Number of flueless gas fires	0	0 (7c)

Infiltration due to chimneys, flues, fans, PSVs (6a) + (6b) + (7a) + (7b) + (7c) = 40 ÷ (5) = 0.15 (8)

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

Air permeability value, q₅₀, expressed in cubic metres per hour per square metre of envelope area 5.00 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.40 (18)

Number of sides on which the dwelling is sheltered 1 (19)

Shelter factor 1 - [0.075 x (19)] = 0.93 (20)

Infiltration rate incorporating shelter factor (18) x (20) = 0.37 (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	0.47	0.46	0.45	0.40	0.40	0.35	0.35	0.34	0.37	0.40	0.41	0.43
---	------	------	------	------	------	------	------	------	------	------	------	------

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

	0.61	0.61	0.60	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59
--	------	------	------	------	------	------	------	------	------	------	------	------

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

	0.61	0.61	0.60	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59
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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			25.78	1.33	34.18		(27)						
External wall			54.22	0.18	9.76		(29a)						
Party wall			51.42	0.00	0.00		(32)						
Roof			103.20	0.13	13.42		(30)						
Total area of external elements ΣA, m ²			183.20				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	57.35	(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						9.16	(36)						
Total fabric heat loss					(33) + (36) =	66.51	(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)	54.44	54.06	53.68	51.93	51.60	50.07	50.07	49.79	50.66	51.60	52.26	52.96	(38)
Heat transfer coefficient, W/K (37)m + (38)m	120.95	120.57	120.20	118.44	118.11	116.58	116.58	116.30	117.17	118.11	118.78	119.47	
	Average = Σ(39)1...12/12 =											118.44	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.17	1.17	1.16	1.15	1.14	1.13	1.13	1.13	1.14	1.14	1.15	1.16	
	Average = Σ(40)1...12/12 =											1.15	(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

4. Water heating energy requirement

Assumed occupancy, N

2.77

(42)

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

99.92

(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)

109.91

105.92

101.92

97.92

93.93

89.93

89.93

93.93

97.92

101.92

105.92

109.91

$\Sigma(44)1...12 =$

1199.06

(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)

163.00

142.56

147.11

128.25

123.06

106.19

98.40

112.92

114.27

133.17

145.36

157.86

$\Sigma(45)1...12 =$

1572.16

(45)

Distribution loss $0.15 \times (45)m$

24.45

21.38

22.07

19.24

18.46

15.93

14.76

16.94

17.14

19.98

21.80

23.68

(46)

180.00

(47)

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

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

212.24	187.04	196.35	175.91	172.31	153.85	147.65	162.16	161.92	182.41	193.02	207.10	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H

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

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

212.24	187.04	196.35	175.91	172.31	153.85	147.65	162.16	161.92	182.41	193.02	207.10	
$\Sigma(64)1...12 =$											2151.95	(64)

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

93.59	82.98	88.31	80.77	80.31	73.43	72.11	76.94	76.12	83.67	86.46	91.88	(65)
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5. Internal gains

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

Metabolic gains (Table 5)

138.36	138.36	138.36	138.36	138.36	138.36	138.36	138.36	138.36	138.36	138.36	138.36	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

23.30	20.70	16.83	12.74	9.53	8.04	8.69	11.30	15.16	19.25	22.47	23.95	(67)
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------	------

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

261.40	264.11	257.28	242.72	224.36	207.09	195.56	192.85	199.68	214.23	232.60	249.87	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	(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)

-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	-110.69	(71)
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Water heating gains (Table 5)

125.79	123.49	118.69	112.18	107.95	101.99	96.93	103.41	105.72	112.46	120.08	123.50	(72)
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Total internal gains $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$

478.01	475.81	460.31	435.15	409.34	384.63	368.68	375.06	388.07	413.45	442.66	464.82	(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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East $0.77 \times 18.52 \times 19.64 \times 0.9 \times 0.63 \times 0.70 = 111.16$ (76)

North $0.77 \times 5.90 \times 10.63 \times 0.9 \times 0.63 \times 0.70 = 19.17$ (74)

South $0.77 \times 1.36 \times 46.75 \times 0.9 \times 0.63 \times 0.70 = 19.43$ (78)

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

149.77	285.92	460.92	668.13	822.56	845.43	803.37	686.29	533.72	335.97	185.29	124.19	(83)
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Total gains - internal and solar $(73)m + (83)m$

627.78	761.73	921.24	1103.28	1231.90	1230.06	1172.06	1061.35	921.79	749.43	627.95	589.01	(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	0.92	0.78	0.59	0.43	0.50	0.78	0.97	1.00	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

19.74	19.93	20.24	20.62	20.88	20.98	21.00	20.99	20.92	20.54	20.07	19.71	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

19.94	19.95	19.95	19.96	19.96	19.98	19.98	19.98	19.97	19.96	19.96	19.95	(88)
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Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.97	0.90	0.73	0.50	0.34	0.39	0.69	0.95	0.99	1.00	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

18.26	18.54	18.99	19.53	19.85	19.96	19.98	19.98	19.91	19.44	18.76	18.23	(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

18.96	19.20	19.58	20.05	20.34	20.45	20.46	20.46	20.39	19.96	19.38	18.93	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.96	19.20	19.58	20.05	20.34	20.45	20.46	20.46	20.39	19.96	19.38	18.93	(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	0.90	0.75	0.54	0.38	0.44	0.73	0.95	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

625.40	754.29	893.41	992.38	920.84	666.05	447.89	467.82	672.92	711.92	622.72	587.36	(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]

1773.44	1723.92	1572.52	1320.71	1020.54	681.43	450.01	472.02	736.60	1105.76	1458.31	1760.25	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

854.15	651.59	505.25	236.40	74.17	0.00	0.00	0.00	0.00	293.01	601.62	872.63	(98)
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Σ(98)1...5, 10...12 = 4088.83 (99)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 39.62 (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

913.52	696.89	540.38	252.83	79.33	0.00	0.00	0.00	0.00	313.38	643.45	933.29	(211)
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Σ(211)1...5, 10...12 = 4373.08 (211)

Water heating

Efficiency of water heater

88.15	87.87	87.23	85.60	82.74	79.80	79.80	79.80	79.80	86.07	87.65	88.23	(217)
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Water heating fuel, kWh/month

240.78	212.85	225.11	205.49	208.24	192.79	185.02	203.21	202.91	211.93	220.23	234.72	(219)
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Σ(219a)1...12 = 2543.28 (219)

Annual totals

Space heating fuel - main system 1		4373.08	
Water heating fuel		2543.28	
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)		411.56	(232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) =		7402.92 (238)

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

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	4373.08	x	3.48	x 0.01 =	152.18	(240)
Water heating	2543.28	x	3.48	x 0.01 =	88.51	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	411.56	x	13.19	x 0.01 =	54.28	(250)
Additional standing charges					120.00	(251)
Total energy cost		(240)...(242) + (245)...(254) =			424.87	(255)

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

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.20	(257)
SAP value	83.20	
SAP rating (section 13)	83	(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	4373.08	x	0.216	=	944.59	(261)
Water heating	2543.28	x	0.216	=	549.35	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1493.93	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	411.56	x	0.519	=	213.60	(268)
Total CO ₂ , kg/year			(265)...(271) =		1746.46	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		16.92	(273)
EI value					84.21	
EI rating (section 14)					84	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	4373.08	x	1.22	=	5335.16	(261)
Water heating	2543.28	x	1.22	=	3102.81	(264)
Space and water heating			(261) + (262) + (263) + (264) =		8437.96	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	411.56	x	3.07	=	1263.47	(268)
Primary energy kWh/year					9931.69	(272)
Dwelling primary energy rate kWh/m ² /year					96.24	(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	5.8 redYellow 42, London		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	121.16 (1a)	2.62 (2a)	317.44 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = 121.16 (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	317.44 (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
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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	0.25	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			57.02	x 1.33	= 75.59		(27)						
External wall			20.22	x 0.18	= 3.64		(29a)						
Party wall			75.31	x 0.00	= 0.00		(32)						
Roof			121.16	x 0.13	= 15.75		(30)						
Total area of external elements ΣA, m ²			198.40				(31)						
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	94.99 (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							29.76 (36)						
Total fabric heat loss						(33) + (36) =	124.75 (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)	29.34	29.00	28.67	27.00	26.67	25.00	25.00	24.66	25.66	26.67	27.33	28.00	(38)
Heat transfer coefficient, W/K (37)m + (38)m	154.08	153.75	153.42	151.75	151.41	149.74	149.74	149.41	150.41	151.41	152.08	152.75	
	Average = Σ(39)1...12/12 =											151.66 (39)	
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.27	1.27	1.27	1.25	1.25	1.24	1.24	1.23	1.24	1.25	1.26	1.26	
	Average = Σ(40)1...12/12 =											1.25 (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												2.87	(42)	
Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$												102.31	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$														
	112.54	108.45	104.35	100.26	96.17	92.08	92.08	96.17	100.26	104.35	108.45	112.54		
												$\Sigma(44)1...12 =$	1227.69	(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)														
	166.89	145.96	150.62	131.32	126.00	108.73	100.75	115.62	117.00	136.35	148.83	161.63		
												$\Sigma(45)1...12 =$	1609.70	(45)
Distribution loss $0.15 \times (45)m$														
	25.03	21.89	22.59	19.70	18.90	16.31	15.11	17.34	17.55	20.45	22.33	24.24	(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)
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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 $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

224.56	198.06	208.29	187.13	183.67	164.54	158.43	173.29	172.81	194.02	204.65	219.30	(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

224.56	198.06	208.29	187.13	183.67	164.54	158.43	173.29	172.81	194.02	204.65	219.30	
$\Sigma(64)1...12 =$											2288.74	(64)

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

101.63	90.21	96.22	88.31	88.03	80.80	79.64	84.58	83.55	91.47	94.14	99.88	(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)

143.38	143.38	143.38	143.38	143.38	143.38	143.38	143.38	143.38	143.38	143.38	143.38	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

25.56	22.70	18.46	13.98	10.45	8.82	9.53	12.39	16.63	21.11	24.64	26.27	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

286.72	289.69	282.19	266.23	246.08	227.15	214.50	211.52	219.02	234.98	255.13	274.07	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	(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)
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Losses e.g. evaporation (Table 5)

-114.71	-114.71	-114.71	-114.71	-114.71	-114.71	-114.71	-114.71	-114.71	-114.71	-114.71	-114.71	(71)
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Water heating gains (Table 5)

136.60	134.24	129.33	122.66	118.32	112.22	107.04	113.68	116.04	122.95	130.75	134.24	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

514.89	512.64	496.00	468.88	440.87	414.21	397.08	403.61	417.71	445.06	476.53	500.60	(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 $0.77 \times 46.00 \times 46.75 \times 0.9 \times 0.45 \times 0.80 = 536.53$ (78)

West $0.77 \times 11.02 \times 19.64 \times 0.9 \times 0.45 \times 0.80 = 54.00$ (80)

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

590.53	984.33	1293.26	1518.76	1629.19	1586.94	1542.57	1464.07	1371.56	1073.10	703.30	508.02	(83)
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Total gains - internal and solar (73)m + (83)m

1105.42	1496.97	1789.26	1987.64	2070.06	2001.15	1939.66	1867.68	1789.27	1518.15	1179.83	1008.61	(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)

0.92	0.86	0.78	0.68	0.57	0.44	0.32	0.35	0.51	0.73	0.88	0.94	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

18.80	19.32	19.83	20.32	20.67	20.88	20.96	20.95	20.81	20.33	19.47	18.70	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

19.86	19.87	19.87	19.88	19.88	19.89	19.89	19.89	19.89	19.88	19.88	19.87	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.91	0.84	0.76	0.65	0.52	0.37	0.25	0.27	0.44	0.68	0.86	0.93	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

16.99	17.71	18.43	19.09	19.53	19.79	19.87	19.86	19.72	19.12	17.94	16.84	(90)
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Living area fraction

Living area ÷ (4) = 0.53 (91)

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

17.95	18.56	19.17	19.74	20.13	20.36	20.44	20.43	20.30	19.76	18.75	17.82	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

17.95	18.56	19.17	19.74	20.13	20.36	20.44	20.43	20.30	19.76	18.75	17.82	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, ηm

0.89	0.82	0.74	0.64	0.53	0.40	0.29	0.31	0.47	0.68	0.84	0.91	(94)
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Useful gains, ηmGm, W (94)m x (84)m

984.23	1226.01	1324.06	1276.95	1095.49	799.64	555.65	578.23	833.96	1031.95	989.41	913.97	(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]

2102.78	2100.28	1943.74	1644.74	1276.55	863.01	575.36	602.82	931.88	1386.27	1771.74	2080.59	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

832.20	587.51	461.04	264.81	134.70	0.00	0.00	0.00	0.00	263.62	563.28	867.97	
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Σ(98)1...5, 10...12 = 3975.12 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 32.81 (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

3975.12 (98)

Space heat from boilers

(98) x (304a) x (305) x (306) = 4173.88 (307a)

Water heating

Annual water heating requirement

2288.74 (64)

Water heat from boilers

(64) x (303a) x (305a) x (306) = 2403.18 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 65.77 (313)

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

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

266.25 (330a)