Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 09 June 2022 at 20:51:39

Project Information:

Assessed By: Michael Langley (STRO036755) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 60.71m²

Site Reference : 11-12 Market Place **Plot Reference:** Flat 16 (Baseline)

Address : Flat 16, 11-12 Market Place, READING, RG1 2EG

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	24.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	24.64 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	79.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	67.4 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	**OK**
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.97 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	**OK**
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.89 kWh/day Permitted by DBSCG: 2.56 kWh/day	**OK**

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Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Time and temperature zone control by device in database	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: North West	2.04m²
Windows facing: North West	2.47m²
Windows facing: North West	2.37m²
Windows facing: North West	2.04m²
Windows facing: North West	3.81m²
Roof windows facing: Horizontal	1.1m²
Roof windows facing: Horizontal	0.76m²
Ventilation rate:	4.00
Blinds/curtains:	None

10 Key features

Party Walls U-value	0 W/m²K

EPC Costs WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Michael Langley	**Stroma Number:**	STRO036755
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: Flat 16 (Baseline)

Address : Flat 16, 11-12 Market Place, READING, RG1 2EG

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	60.71	(1a) x	3.5	(2a) =	212.48	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	60.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		212.48	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	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 and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.09	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.96999979019165	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.34	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(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 7												
(22)m=	4.3	4.1	4.1	3.8	3.9	3.4	3.4	3.3	3.4	3.8	3.7	4
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.08	1.02	1.02	0.95	0.98	0.85	0.85	0.82	0.85	0.95	0.92	1

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

0.34	0.32	0.32	0.3	0.31	0.27	0.27	0.26	0.27	0.3	0.29	0.32

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

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

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.56	0.55	0.55	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.54	0.55	(24d)

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

(25)m=	0.56	0.55	0.55	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.54	0.55	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 2			2.47	x1/[1/(1.4)+ 0.04]		=	3.27			(27)
Windows Type 3			2.37	x1/[1/(1.4)+ 0.04]		=	3.14			(27)
Windows Type 4			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 5			3.81	x1/[1/(1.4)+ 0.04]		=	5.05			(27)
Rooflights Type 1			1.1	x1/[1/(1.4) + 0.04]		=	1.54			(27b)
Rooflights Type 2			0.765	x1/[1/(1.4) + 0.04]		=	1.071			(27b)
Walls	76.51	12.73	63.78	x	0.18	=	11.48			(29)
Roof	60.71	1.87	58.84	x	0.13	=	7.65			(30)
Total area of elements, m²			137.22							(31)
Party wall			55.51	x	0	=	0			(32)
Party floor			60.71							(32a)
Internal wall **			168.16							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.48 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6155.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 18.97 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 57.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.13	38.76	38.76	38.24	38.41	37.6	37.6	37.46	37.6	38.24	38.07	38.58	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.58	96.21	96.21	95.69	95.86	95.05	95.05	94.91	95.05	95.69	95.52	96.03

Average = Sum(39)$_{1...12}$ /12= 95.65 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.59	1.58	1.58	1.58	1.58	1.57	1.57	1.56	1.57	1.58	1.57	1.58

Average = Sum(40)$_{1...12}$ /12= 1.58 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 81.74 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	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)

(44)m=	89.91	86.64	83.37	80.1	76.83	73.56	73.56	76.83	80.1	83.37	86.64	89.91

Total = Sum(44)$_{1...12}$ = 980.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	133.34	116.62	120.34	104.91	100.67	86.87	80.5	92.37	93.47	108.94	118.91	129.13

Total = Sum(45)$_{1...12}$ = 1286.07 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20	17.49	18.05	15.74	15.1	13.03	12.07	13.86	14.02	16.34	17.84	19.37	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 250 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.89 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.02 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 1.02 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	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 calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.24	166.21	175.24	158.04	155.57	140	135.4	147.27	146.6	163.84	172.04	184.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.24	166.21	175.24	158.04	155.57	140	135.4	147.27	146.6	163.84	172.04	184.03

Output from water heater (annual)$_{1...12}$ | 1932.49 | (64)

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

(65)m=	88.26	78.45	83.93	77.39	77.39	71.39	70.69	74.63	73.58	80.14	82.04	86.86	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.1	120.1	120.1	120.1	120.1	120.1	120.1	120.1	120.1	120.1	120.1	120.1	(66)

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

(67)m=	38.94	34.59	28.13	21.3	15.92	13.44	14.52	18.88	25.34	32.17	37.55	40.03	(67)

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

(68)m=	260.8	263.5	256.68	242.17	223.84	206.61	195.11	192.4	199.22	213.74	232.07	249.29	(68)

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

(69)m=	49.01	49.01	49.01	49.01	49.01	49.01	49.01	49.01	49.01	49.01	49.01	49.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	(71)

Water heating gains (Table 5)

(72)m=	118.62	116.74	112.81	107.48	104.02	99.15	95.01	100.31	102.2	107.72	113.95	116.74	(72)

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

(73)m=	510.41	506.87	489.67	462.99	435.82	411.25	396.68	403.64	418.8	445.67	475.6	498.1	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	2.04	x	13.78	x	0.63	x	0.8	=	9.82	(81)
Northwest 0.9x	0.77	x	2.47	x	13.78	x	0.63	x	0.8	=	11.89	(81)
Northwest 0.9x	0.77	x	2.37	x	13.78	x	0.63	x	0.8	=	11.41	(81)
Northwest 0.9x	0.77	x	2.04	x	13.78	x	0.63	x	0.8	=	9.82	(81)
Northwest 0.9x	0.77	x	3.81	x	13.78	x	0.63	x	0.8	=	18.34	(81)
Northwest 0.9x	0.77	x	2.04	x	24.65	x	0.63	x	0.8	=	17.56	(81)
Northwest 0.9x	0.77	x	2.47	x	24.65	x	0.63	x	0.8	=	21.26	(81)
Northwest 0.9x	0.77	x	2.37	x	24.65	x	0.63	x	0.8	=	20.4	(81)
Northwest 0.9x	0.77	x	2.04	x	24.65	x	0.63	x	0.8	=	17.56	(81)
Northwest 0.9x	0.77	x	3.81	x	24.65	x	0.63	x	0.8	=	32.8	(81)
Northwest 0.9x	0.77	x	2.04	x	44.26	x	0.63	x	0.8	=	31.53	(81)
Northwest 0.9x	0.77	x	2.47	x	44.26	x	0.63	x	0.8	=	38.18	(81)
Northwest 0.9x	0.77	x	2.37	x	44.26	x	0.63	x	0.8	=	36.63	(81)
Northwest 0.9x	0.77	x	2.04	x	44.26	x	0.63	x	0.8	=	31.53	(81)
Northwest 0.9x	0.77	x	3.81	x	44.26	x	0.63	x	0.8	=	58.89	(81)
Northwest 0.9x	0.77	x	2.04	x	73.71	x	0.63	x	0.8	=	52.52	(81)
Northwest 0.9x	0.77	x	2.47	x	73.71	x	0.63	x	0.8	=	63.59	(81)
Northwest 0.9x	0.77	x	2.37	x	73.71	x	0.63	x	0.8	=	61.02	(81)
Northwest 0.9x	0.77	x	2.04	x	73.71	x	0.63	x	0.8	=	52.52	(81)
Northwest 0.9x	0.77	x	3.81	x	73.71	x	0.63	x	0.8	=	98.09	(81)
Northwest 0.9x	0.77	x	2.04	x	96.2	x	0.63	x	0.8	=	68.54	(81)
Northwest 0.9x	0.77	x	2.47	x	96.2	x	0.63	x	0.8	=	82.99	(81)
Northwest 0.9x	0.77	x	2.37	x	96.2	x	0.63	x	0.8	=	79.63	(81)
Northwest 0.9x	0.77	x	2.04	x	96.2	x	0.63	x	0.8	=	68.54	(81)
Northwest 0.9x	0.77	x	3.81	x	96.2	x	0.63	x	0.8	=	128.01	(81)
Northwest 0.9x	0.77	x	2.04	x	108.24	x	0.63	x	0.8	=	77.12	(81)
Northwest 0.9x	0.77	x	2.47	x	108.24	x	0.63	x	0.8	=	93.38	(81)
Northwest 0.9x	0.77	x	2.37	x	108.24	x	0.63	x	0.8	=	89.6	(81)
Northwest 0.9x	0.77	x	2.04	x	108.24	x	0.63	x	0.8	=	77.12	(81)
Northwest 0.9x	0.77	x	3.81	x	108.24	x	0.63	x	0.8	=	144.04	(81)
Northwest 0.9x	0.77	x	2.04	x	100.36	x	0.63	x	0.8	=	71.51	(81)
Northwest 0.9x	0.77	x	2.47	x	100.36	x	0.63	x	0.8	=	86.58	(81)
Northwest 0.9x	0.77	x	2.37	x	100.36	x	0.63	x	0.8	=	83.07	(81)
Northwest 0.9x	0.77	x	2.04	x	100.36	x	0.63	x	0.8	=	71.51	(81)
Northwest 0.9x	0.77	x	3.81	x	100.36	x	0.63	x	0.8	=	133.55	(81)
Northwest 0.9x	0.77	x	2.04	x	82.32	x	0.63	x	0.8	=	58.65	(81)
Northwest 0.9x	0.77	x	2.47	x	82.32	x	0.63	x	0.8	=	71.01	(81)
Northwest 0.9x	0.77	x	2.37	x	82.32	x	0.63	x	0.8	=	68.14	(81)
Northwest 0.9x	0.77	x	2.04	x	82.32	x	0.63	x	0.8	=	58.65	(81)

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Northwest 0.9x	0.77	x	3.81	x	82.32	x	0.63	x	0.8	=	109.54	(81)
Northwest 0.9x	0.77	x	2.04	x	57.5	x	0.63	x	0.8	=	40.97	(81)
Northwest 0.9x	0.77	x	2.47	x	57.5	x	0.63	x	0.8	=	49.6	(81)
Northwest 0.9x	0.77	x	2.37	x	57.5	x	0.63	x	0.8	=	47.59	(81)
Northwest 0.9x	0.77	x	2.04	x	57.5	x	0.63	x	0.8	=	40.97	(81)
Northwest 0.9x	0.77	x	3.81	x	57.5	x	0.63	x	0.8	=	76.51	(81)
Northwest 0.9x	0.77	x	2.04	x	32.39	x	0.63	x	0.8	=	23.08	(81)
Northwest 0.9x	0.77	x	2.47	x	32.39	x	0.63	x	0.8	=	27.95	(81)
Northwest 0.9x	0.77	x	2.37	x	32.39	x	0.63	x	0.8	=	26.81	(81)
Northwest 0.9x	0.77	x	2.04	x	32.39	x	0.63	x	0.8	=	23.08	(81)
Northwest 0.9x	0.77	x	3.81	x	32.39	x	0.63	x	0.8	=	43.11	(81)
Northwest 0.9x	0.77	x	2.04	x	17.11	x	0.63	x	0.8	=	12.19	(81)
Northwest 0.9x	0.77	x	2.47	x	17.11	x	0.63	x	0.8	=	14.76	(81)
Northwest 0.9x	0.77	x	2.37	x	17.11	x	0.63	x	0.8	=	14.16	(81)
Northwest 0.9x	0.77	x	2.04	x	17.11	x	0.63	x	0.8	=	12.19	(81)
Northwest 0.9x	0.77	x	3.81	x	17.11	x	0.63	x	0.8	=	22.77	(81)
Northwest 0.9x	0.77	x	2.04	x	11.3	x	0.63	x	0.8	=	8.05	(81)
Northwest 0.9x	0.77	x	2.47	x	11.3	x	0.63	x	0.8	=	9.75	(81)
Northwest 0.9x	0.77	x	2.37	x	11.3	x	0.63	x	0.8	=	9.35	(81)
Northwest 0.9x	0.77	x	2.04	x	11.3	x	0.63	x	0.8	=	8.05	(81)
Northwest 0.9x	0.77	x	3.81	x	11.3	x	0.63	x	0.8	=	15.03	(81)
Rooflights 0.9x	1	x	1.1	x	32	x	0.63	x	0.8	=	15.97	(82)
Rooflights 0.9x	1	x	0.76	x	32	x	0.63	x	0.8	=	11.1	(82)
Rooflights 0.9x	1	x	1.1	x	58	x	0.63	x	0.8	=	28.94	(82)
Rooflights 0.9x	1	x	0.76	x	58	x	0.63	x	0.8	=	20.13	(82)
Rooflights 0.9x	1	x	1.1	x	102	x	0.63	x	0.8	=	50.89	(82)
Rooflights 0.9x	1	x	0.76	x	102	x	0.63	x	0.8	=	35.39	(82)
Rooflights 0.9x	1	x	1.1	x	161	x	0.63	x	0.8	=	80.33	(82)
Rooflights 0.9x	1	x	0.76	x	161	x	0.63	x	0.8	=	55.87	(82)
Rooflights 0.9x	1	x	1.1	x	200	x	0.63	x	0.8	=	99.79	(82)
Rooflights 0.9x	1	x	0.76	x	200	x	0.63	x	0.8	=	69.4	(82)
Rooflights 0.9x	1	x	1.1	x	220	x	0.63	x	0.8	=	109.77	(82)
Rooflights 0.9x	1	x	0.76	x	220	x	0.63	x	0.8	=	76.34	(82)
Rooflights 0.9x	1	x	1.1	x	206	x	0.63	x	0.8	=	102.79	(82)
Rooflights 0.9x	1	x	0.76	x	206	x	0.63	x	0.8	=	71.48	(82)
Rooflights 0.9x	1	x	1.1	x	176	x	0.63	x	0.8	=	87.82	(82)
Rooflights 0.9x	1	x	0.76	x	176	x	0.63	x	0.8	=	61.07	(82)
Rooflights 0.9x	1	x	1.1	x	130	x	0.63	x	0.8	=	64.86	(82)
Rooflights 0.9x	1	x	0.76	x	130	x	0.63	x	0.8	=	45.11	(82)
Rooflights 0.9x	1	x	1.1	x	76	x	0.63	x	0.8	=	37.92	(82)
Rooflights 0.9x	1	x	0.76	x	76	x	0.63	x	0.8	=	26.37	(82)

EPC Costs WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	1.1	x	40	x	0.63	x	0.8	=	19.96	(82)
Rooflights 0.9x	1	x	0.76	x	40	x	0.63	x	0.8	=	13.88	(82)
Rooflights 0.9x	1	x	1.1	x	26	x	0.63	x	0.8	=	12.97	(82)
Rooflights 0.9x	1	x	0.76	x	26	x	0.63	x	0.8	=	9.02	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	88.34	158.65	283.06	463.95	596.9	667.37	620.49	514.88	365.62	208.32	109.92	72.23	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	598.75	665.52	772.73	926.94	1032.72	1078.62	1017.17	918.52	784.42	653.99	585.52	570.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.98	0.94	0.85	0.67	0.45	0.31	0.35	0.66	0.9	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.82	20.17	20.6	20.88	20.98	21	21	20.92	20.54	20.03	19.62	(87)

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

(88)m=	19.62	19.62	19.62	19.63	19.63	19.64	19.64	19.64	19.64	19.63	19.63	19.63	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.97	0.92	0.8	0.58	0.34	0.18	0.21	0.54	0.86	0.96	0.98	(89)

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

(90)m=	17.91	18.16	18.65	19.23	19.54	19.63	19.64	19.64	19.59	19.18	18.48	17.87	(90)

fLA = Living area ÷ (4) = 0.31 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.44	18.67	19.12	19.65	19.95	20.05	20.06	20.06	20	19.6	18.96	18.41	(92)

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

(93)m=	18.44	18.67	19.12	19.65	19.95	20.05	20.06	20.06	20	19.6	18.96	18.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.96	0.92	0.8	0.61	0.37	0.22	0.25	0.57	0.86	0.95	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	582.37	637.89	707.33	741.75	625.78	398.61	223.66	232.53	447.39	561.78	557.84	556.8	(95)
Monthly average external temperature from Table 8													
(96)m=	5.1	5.7	7.4	9.9	12.9	15.8	17.7	17.6	15	11.5	8	5.1	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1288.79	1248.23	1127.82	933.38	676.17	403.83	224.1	233.29	475.61	775.03	1046.79	1278.31	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	525.58	410.15	312.84	137.97	37.49	0	0	0	0	158.66	352.04	536.8	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2471.53 (98)

Space heating requirement in kWh/m²/year 40.71 (99)

EPC Costs WorkSheet: New dwelling design stage

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	525.58	410.15	312.84	137.97	37.49	0	0	0	0	158.66	352.04	536.8	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	580.75	453.2	345.68	152.46	41.43	0	0	0	0	175.31	389	593.15	(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2730.98 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

Water heating

Output from water heater (calculated above)	188.24	166.21	175.24	158.04	155.57	140	135.4	147.27	146.6	163.84	172.04	184.03	
Efficiency of water heater													79.8 (216)
(217)m=	87.41	87.13	86.34	84.45	81.68	79.8	79.8	79.8	79.8	84.73	86.68	87.5	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	215.35	190.75	202.96	187.14	190.47	175.44	169.67	184.55	183.72	193.37	198.47	210.31	
Total = Sum(219a)$_{1...12}$ =													2302.2 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2730.98	
Water heating fuel used			2302.2	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			275.11	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			5383.28	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.63	x 0.01 =	99.13	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	19.44	x 0.01 =	0	(242)

EPC Costs WorkSheet: New dwelling design stage

Water heating cost (other fuel)	(219)	3.63	x 0.01 =	83.57	(247)
Pumps, fans and electric keep-hot	(231)	0	x 0.01 =	14.58	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	0	x 0.01 =	53.48	(250)
Additional standing charges (Table 12)				95	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)…(254) =	345.77	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		81.08	(258)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	589.89	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	497.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1087.17	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	142.78	(268)
Total CO2, kg/year		sum of (265)…(271) =		1268.87	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		20.9	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3331.79	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2808.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =			6140.48	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	844.58	(268)
'Total Primary Energy		sum of (265)…(271) =		7215.3	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		118.85	(273)

Code for Sustainable Homes Report

For use with Nov 2010 addendum 2014 England

Assessor and House Details

Assessor Name: Michael Langley
Assessor Number: STRO036755
Property Address: Flat 16
11-12 Market Place
READING
RG1 2EG

Buiding regulation assessment

	kg/m²/year
TER	24.64
DER	24.64

ENE 1 Assessment - Dwelling Emission Rate

Total Energy Type CO_2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2012 DER Worksheet		24.64	*(ZC1)*
TER		24.64	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		24.64	
% improvement DER/TER	0		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	24.64	*(ZC1)*
CO2 emissions from appliances, equation (L14)	16.99	*(ZC2)*
CO2 emissions from cooking, equation (L16)	2.75	*(ZC3)*
Net CO2 emissions	45.9	*(ZC8)*

Result:

Credits awarded for ENE 1 = 0

Code Level = 3

ENE 2 - Fabric energy Efficiency

Fabric energy Efficiency: 67.37
Credits awarded for ENE 2 = 0

ENE 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		45.85
Standard DER		26.11
Actual Case CO2 emissions		45.85
Actual DER		26.11
Reduction in CO2 emissions	0	

Credits awarded for ENE 7 = 0

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Michael Langley	**Stroma Number:**	STRO036755
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: Flat 16 (Baseline)

Address : Flat 16, 11-12 Market Place, READING, RG1 2EG

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	60.71	(1a) x	3.5	(2a) =	212.48	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	60.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		212.48	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	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 and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.09	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.96999979019165	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.34	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(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 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

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

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

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

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 2			2.47	x1/[1/(1.4)+ 0.04]		=	3.27			(27)
Windows Type 3			2.37	x1/[1/(1.4)+ 0.04]		=	3.14			(27)
Windows Type 4			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 5			3.81	x1/[1/(1.4)+ 0.04]		=	5.05			(27)
Rooflights Type 1			1.1	x1/[1/(1.4) + 0.04]		=	1.54			(27b)
Rooflights Type 2			0.765	x1/[1/(1.4) + 0.04]		=	1.071			(27b)
Walls	76.51	12.73	63.78	x	0.18	=	11.48			(29)
Roof	60.71	1.87	58.84	x	0.13	=	7.65			(30)
Total area of elements, m²			137.22							(31)
Party wall			55.51	x	0	=	0			(32)
Party floor			60.71							(32a)
Internal wall **			168.16							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.48 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6155.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 18.97 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 57.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.78	40.56	40.34	39.32	39.13	38.24	38.24	38.07	38.58	39.13	39.52	39.92	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	98.23	98.01	97.79	96.77	96.58	95.69	95.69	95.52	96.03	96.58	96.97	97.37

Average = Sum(39)$_{1...12}$ /12= 96.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.62	1.61	1.61	1.59	1.59	1.58	1.58	1.57	1.58	1.59	1.6	1.6

Average = Sum(40)$_{1...12}$ /12= 1.59 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 81.74 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	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)

(44)m=	89.91	86.64	83.37	80.1	76.83	73.56	73.56	76.83	80.1	83.37	86.64	89.91

Total = Sum(44)$_{1...12}$ = 980.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	133.34	116.62	120.34	104.91	100.67	86.87	80.5	92.37	93.47	108.94	118.91	129.13

Total = Sum(45)$_{1...12}$ = 1286.07 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20	17.49	18.05	15.74	15.1	13.03	12.07	13.86	14.02	16.34	17.84	19.37	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 250 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.89 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.02 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 1.02 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	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 calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.24	166.21	175.24	158.04	155.57	140	135.4	147.27	146.6	163.84	172.04	184.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.24	166.21	175.24	158.04	155.57	140	135.4	147.27	146.6	163.84	172.04	184.03

Output from water heater (annual)$_{1...12}$ | 1932.49 | (64)

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

(65)m=	88.26	78.45	83.93	77.39	77.39	71.39	70.69	74.63	73.58	80.14	82.04	86.86	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	(66)

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

(67)m=	15.58	13.84	11.25	8.52	6.37	5.38	5.81	7.55	10.13	12.87	15.02	16.01	(67)

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

(68)m=	174.73	176.55	171.98	162.25	149.97	138.43	130.72	128.91	133.48	143.2	155.48	167.02	(68)

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

(69)m=	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	(71)

Water heating gains (Table 5)

(72)m=	118.62	116.74	112.81	107.48	104.02	99.15	95.01	100.31	102.2	107.72	113.95	116.74	(72)

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

(73)m=	364.96	363.14	352.07	334.28	316.39	298.98	287.56	292.8	301.84	319.82	340.47	355.8	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	2.04	x	11.28	x	0.63	x	0.8	=	8.04	(81)
Northwest 0.9x	0.77	x	2.47	x	11.28	x	0.63	x	0.8	=	9.73	(81)
Northwest 0.9x	0.77	x	2.37	x	11.28	x	0.63	x	0.8	=	9.34	(81)
Northwest 0.9x	0.77	x	2.04	x	11.28	x	0.63	x	0.8	=	8.04	(81)
Northwest 0.9x	0.77	x	3.81	x	11.28	x	0.63	x	0.8	=	15.01	(81)
Northwest 0.9x	0.77	x	2.04	x	22.97	x	0.63	x	0.8	=	16.36	(81)
Northwest 0.9x	0.77	x	2.47	x	22.97	x	0.63	x	0.8	=	19.81	(81)
Northwest 0.9x	0.77	x	2.37	x	22.97	x	0.63	x	0.8	=	19.01	(81)
Northwest 0.9x	0.77	x	2.04	x	22.97	x	0.63	x	0.8	=	16.36	(81)
Northwest 0.9x	0.77	x	3.81	x	22.97	x	0.63	x	0.8	=	30.56	(81)
Northwest 0.9x	0.77	x	2.04	x	41.38	x	0.63	x	0.8	=	29.48	(81)
Northwest 0.9x	0.77	x	2.47	x	41.38	x	0.63	x	0.8	=	35.7	(81)
Northwest 0.9x	0.77	x	2.37	x	41.38	x	0.63	x	0.8	=	34.25	(81)
Northwest 0.9x	0.77	x	2.04	x	41.38	x	0.63	x	0.8	=	29.48	(81)
Northwest 0.9x	0.77	x	3.81	x	41.38	x	0.63	x	0.8	=	55.06	(81)
Northwest 0.9x	0.77	x	2.04	x	67.96	x	0.63	x	0.8	=	48.42	(81)
Northwest 0.9x	0.77	x	2.47	x	67.96	x	0.63	x	0.8	=	58.63	(81)
Northwest 0.9x	0.77	x	2.37	x	67.96	x	0.63	x	0.8	=	56.25	(81)
Northwest 0.9x	0.77	x	2.04	x	67.96	x	0.63	x	0.8	=	48.42	(81)
Northwest 0.9x	0.77	x	3.81	x	67.96	x	0.63	x	0.8	=	90.43	(81)
Northwest 0.9x	0.77	x	2.04	x	91.35	x	0.63	x	0.8	=	65.09	(81)
Northwest 0.9x	0.77	x	2.47	x	91.35	x	0.63	x	0.8	=	78.8	(81)
Northwest 0.9x	0.77	x	2.37	x	91.35	x	0.63	x	0.8	=	75.61	(81)
Northwest 0.9x	0.77	x	2.04	x	91.35	x	0.63	x	0.8	=	65.09	(81)
Northwest 0.9x	0.77	x	3.81	x	91.35	x	0.63	x	0.8	=	121.56	(81)
Northwest 0.9x	0.77	x	2.04	x	97.38	x	0.63	x	0.8	=	69.39	(81)
Northwest 0.9x	0.77	x	2.47	x	97.38	x	0.63	x	0.8	=	84.01	(81)
Northwest 0.9x	0.77	x	2.37	x	97.38	x	0.63	x	0.8	=	80.61	(81)
Northwest 0.9x	0.77	x	2.04	x	97.38	x	0.63	x	0.8	=	69.39	(81)
Northwest 0.9x	0.77	x	3.81	x	97.38	x	0.63	x	0.8	=	129.59	(81)
Northwest 0.9x	0.77	x	2.04	x	91.1	x	0.63	x	0.8	=	64.91	(81)
Northwest 0.9x	0.77	x	2.47	x	91.1	x	0.63	x	0.8	=	78.59	(81)
Northwest 0.9x	0.77	x	2.37	x	91.1	x	0.63	x	0.8	=	75.41	(81)
Northwest 0.9x	0.77	x	2.04	x	91.1	x	0.63	x	0.8	=	64.91	(81)
Northwest 0.9x	0.77	x	3.81	x	91.1	x	0.63	x	0.8	=	121.23	(81)
Northwest 0.9x	0.77	x	2.04	x	72.63	x	0.63	x	0.8	=	51.75	(81)
Northwest 0.9x	0.77	x	2.47	x	72.63	x	0.63	x	0.8	=	62.66	(81)
Northwest 0.9x	0.77	x	2.37	x	72.63	x	0.63	x	0.8	=	60.12	(81)
Northwest 0.9x	0.77	x	2.04	x	72.63	x	0.63	x	0.8	=	51.75	(81)

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Northwest 0.9x	0.77	x	3.81	x	72.63	x	0.63	x	0.8	=	96.65	(81)
Northwest 0.9x	0.77	x	2.04	x	50.42	x	0.63	x	0.8	=	35.93	(81)
Northwest 0.9x	0.77	x	2.47	x	50.42	x	0.63	x	0.8	=	43.5	(81)
Northwest 0.9x	0.77	x	2.37	x	50.42	x	0.63	x	0.8	=	41.74	(81)
Northwest 0.9x	0.77	x	2.04	x	50.42	x	0.63	x	0.8	=	35.93	(81)
Northwest 0.9x	0.77	x	3.81	x	50.42	x	0.63	x	0.8	=	67.1	(81)
Northwest 0.9x	0.77	x	2.04	x	28.07	x	0.63	x	0.8	=	20	(81)
Northwest 0.9x	0.77	x	2.47	x	28.07	x	0.63	x	0.8	=	24.21	(81)
Northwest 0.9x	0.77	x	2.37	x	28.07	x	0.63	x	0.8	=	23.23	(81)
Northwest 0.9x	0.77	x	2.04	x	28.07	x	0.63	x	0.8	=	20	(81)
Northwest 0.9x	0.77	x	3.81	x	28.07	x	0.63	x	0.8	=	37.35	(81)
Northwest 0.9x	0.77	x	2.04	x	14.2	x	0.63	x	0.8	=	10.12	(81)
Northwest 0.9x	0.77	x	2.47	x	14.2	x	0.63	x	0.8	=	12.25	(81)
Northwest 0.9x	0.77	x	2.37	x	14.2	x	0.63	x	0.8	=	11.75	(81)
Northwest 0.9x	0.77	x	2.04	x	14.2	x	0.63	x	0.8	=	10.12	(81)
Northwest 0.9x	0.77	x	3.81	x	14.2	x	0.63	x	0.8	=	18.89	(81)
Northwest 0.9x	0.77	x	2.04	x	9.21	x	0.63	x	0.8	=	6.57	(81)
Northwest 0.9x	0.77	x	2.47	x	9.21	x	0.63	x	0.8	=	7.95	(81)
Northwest 0.9x	0.77	x	2.37	x	9.21	x	0.63	x	0.8	=	7.63	(81)
Northwest 0.9x	0.77	x	2.04	x	9.21	x	0.63	x	0.8	=	6.57	(81)
Northwest 0.9x	0.77	x	3.81	x	9.21	x	0.63	x	0.8	=	12.26	(81)
Rooflights 0.9x	1	x	1.1	x	26	x	0.63	x	0.8	=	12.97	(82)
Rooflights 0.9x	1	x	0.76	x	26	x	0.63	x	0.8	=	9.02	(82)
Rooflights 0.9x	1	x	1.1	x	54	x	0.63	x	0.8	=	26.94	(82)
Rooflights 0.9x	1	x	0.76	x	54	x	0.63	x	0.8	=	18.74	(82)
Rooflights 0.9x	1	x	1.1	x	96	x	0.63	x	0.8	=	47.9	(82)
Rooflights 0.9x	1	x	0.76	x	96	x	0.63	x	0.8	=	33.31	(82)
Rooflights 0.9x	1	x	1.1	x	150	x	0.63	x	0.8	=	74.84	(82)
Rooflights 0.9x	1	x	0.76	x	150	x	0.63	x	0.8	=	52.05	(82)
Rooflights 0.9x	1	x	1.1	x	192	x	0.63	x	0.8	=	95.8	(82)
Rooflights 0.9x	1	x	0.76	x	192	x	0.63	x	0.8	=	66.62	(82)
Rooflights 0.9x	1	x	1.1	x	200	x	0.63	x	0.8	=	99.79	(82)
Rooflights 0.9x	1	x	0.76	x	200	x	0.63	x	0.8	=	69.4	(82)
Rooflights 0.9x	1	x	1.1	x	189	x	0.63	x	0.8	=	94.3	(82)
Rooflights 0.9x	1	x	0.76	x	189	x	0.63	x	0.8	=	65.58	(82)
Rooflights 0.9x	1	x	1.1	x	157	x	0.63	x	0.8	=	78.34	(82)
Rooflights 0.9x	1	x	0.76	x	157	x	0.63	x	0.8	=	54.48	(82)
Rooflights 0.9x	1	x	1.1	x	115	x	0.63	x	0.8	=	57.38	(82)
Rooflights 0.9x	1	x	0.76	x	115	x	0.63	x	0.8	=	39.91	(82)
Rooflights 0.9x	1	x	1.1	x	66	x	0.63	x	0.8	=	32.93	(82)
Rooflights 0.9x	1	x	0.76	x	66	x	0.63	x	0.8	=	22.9	(82)

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Rooflights 0.9x	1	x	1.1	x	33	x	0.63	x	0.8	=	16.47	(82)
Rooflights 0.9x	1	x	0.76	x	33	x	0.63	x	0.8	=	11.45	(82)
Rooflights 0.9x	1	x	1.1	x	21	x	0.63	x	0.8	=	10.48	(82)
Rooflights 0.9x	1	x	0.76	x	21	x	0.63	x	0.8	=	7.29	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	72.16	147.8	265.19	429.04	568.57	602.19	564.94	455.73	321.47	180.63	91.04	58.73	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	437.12	510.94	617.26	763.32	884.96	901.17	852.51	748.53	623.3	500.44	431.51	414.54	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.62	0.48	0.56	0.82	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.28	19.47	19.84	20.34	20.73	20.93	20.98	20.97	20.78	20.25	19.68	19.25	(87)

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

(88)m=	19.6	19.6	19.61	19.62	19.62	19.63	19.63	19.63	19.63	19.62	19.62	19.61	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.9	0.73	0.51	0.34	0.41	0.73	0.95	0.99	1	(89)

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

(90)m=	17.37	17.65	18.18	18.88	19.38	19.59	19.63	19.62	19.47	18.79	17.97	17.33	(90)

fLA = Living area ÷ (4) = | 0.31 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.96	18.21	18.69	19.33	19.8	20	20.04	20.04	19.87	19.24	18.5	17.93	(92)

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

(93)m=	17.96	18.21	18.69	19.33	19.8	20	20.04	20.04	19.87	19.24	18.5	17.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.89	0.74	0.54	0.38	0.45	0.75	0.94	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	433.23	502.57	593.03	679.5	658.74	490.52	324.66	338.1	466.14	470.92	424.72	411.5	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1341.84	1304.57	1191.98	1009.2	781.94	516.93	329.49	347.33	554.33	834.48	1105.09	1336.51	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	676.01	538.94	445.62	237.39	91.66	0	0	0	0	270.49	489.87	688.2	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 3438.17 | (98)

Space heating requirement in kWh/m²/year | 56.63 | (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	676.01	538.94	445.62	237.39	91.66	0	0	0	0	270.49	489.87	688.2	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	746.97	595.51	492.4	262.3	101.28	0	0	0	0	298.88	541.29	760.45	(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3799.09 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	188.24	166.21	175.24	158.04	155.57	140	135.4	147.27	146.6	163.84	172.04	184.03		
Efficiency of water heater													79.8	(216)
(217)m=	87.93	87.73	87.2	85.9	83.46	79.8	79.8	79.8	79.8	86.14	87.45	88.01		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	214.07	189.46	200.96	183.99	186.4	175.44	169.67	184.55	183.72	190.19	196.73	209.1		
Total = Sum(219a)$_{1...12}$ =													2284.29	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3799.09	
Water heating fuel used		2284.29	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		275.11	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6433.48	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	820.6	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	493.41	(264)

DER WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =			1314.01	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	142.78	(268)
Total CO2, kg/year		sum of (265)…(271) =		1495.71	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		24.64	(273)
EI rating (section 14)				81	(274)

Developer Confirmation Report

Property Details: Flat 16 (Baseline)

Address:	Flat 16, 11-12 Market Place, READING, RG1 2EG
Located in:	England
Region:	Thames valley
UPRN:	UPRN-000310041680
Date of assessment:	06 June 2022
Date of certificate:	09 June 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Thermal Mass Parameter:	Indicative Value Medium

Comments:

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022
Front of dwelling faces:	East

Comments:

Opening types:

Name:	Type:	Frame Factor:	g-value:	U-Value:	Area:
NW Glazing 01	Windows	0.8	0.63	1.4	2.04
NW Glazing 02	Windows	0.8	0.63	1.4	2.47
NW Glazing 03	Windows	0.8	0.63	1.4	2.37
NW Glazed Door 01	Windows	0.8	0.63	1.4	2.04
NW Glazed Door 02	Windows	0.8	0.63	1.4	3.81
H Rooflight 01	Roof Windows	0.8	0.63	1.4	1.1
H Rooflight 02	Roof Windows	0.8	0.63	1.4	0.765

Overshading: Average or unknown

Comments:

Opaque Elements:

Type:	U-Value:		Kappa:
External Elements			
External Improved Brick Cavity Wall	0.18	Please provide the U-Value calculation to justify the U-Value entered into the assessment.	N/A

Developer Confirmation Report

Materials Used:

Type:	Name:	Thickness:	Conductivity:	R-Value:

Comments:

External Improved Flat Roofs 0.13 Please provide the U-Value calculation to justify the U-Value entered into the assessment. N/A

Materials Used:

Type:	Name:	Thickness:	Conductivity:	R-Value:
External Improved Flat Roofs	Internal Surface Resistance	0	0	0.1
External Improved Flat Roofs	Plaster Skim (3 mm)	3	0.18	0.02
External Improved Flat Roofs	Plasterboard Standard (12.5 mm)	12.5	0.21	0.06
External Improved Flat Roofs	Roof Joists/Airspace (250 mm)	250	0	0.16
External Improved Flat Roofs	Plywood (Hardwood) (18 mm)	18	0.18	0.1
External Improved Flat Roofs	Vapour Control Membrane (1 mm)	1	1	0
External Improved Flat Roofs	Kingspan TR27 Insulation Boards (175 mm)	175	0.024	7.29
External Improved Flat Roofs	Fleece Underlay (1 mm)	1	1	0
External Improved Flat Roofs	Sika-Trocal Membrane (1 mm)	1	1	0
External Improved Flat Roofs	External Surface Resistance	0	0	0.04

Comments:

Internal Elements (Area, Kappa)

Internal Stud Walls 168.16 N/A

Comments:

Party Elements (Area, Kappa)

Party Stud Walls 55.51 N/A

Comments:

Party Plank Floors 60.71 N/A

Comments:

Developer Confirmation Report

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1382

Length	Psi-value		
5.92	0.05	E2	Other lintels (including other steel lintels)
5.92	0.05	E3	Sill
21.5	0.05	E4	Jamb
21.86	0.07	E7	Party floor between dwellings (in blocks of flats)
21.86	0.56	E15	Flat roof with parapet
7	0.09	E16	Corner (normal)
7	0.06	E18	Party wall between dwellings
15.86	0	P3	Intermediate floor between dwellings (in blocks of flats)
15.86	0.12	P4	Roof (insulation at ceiling level)
1.95	0.08	R1	Head
1.95	0.06	R2	Sill
3.8	0.08	R3	Jamb

Comments:

If specific construction details have been adopted then please provide the associated checklists; signed and dated.

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Natural ventilation (extract fans)
Pressure test: 4.97
Comments:

Please provide the pressure test certificate, or certificates if the result is based on an average; signed and dated.

Main heating system:

Main heating system:
Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Manufacturer Declaration
Manufacturer's data
Efficiency: 89.5% (SEDBUK2009)
Regular condensing with automatic ignition
Fuel Burning Type: Modulation
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Room-sealed
Boiler interlock: Yes

Comments:

Developer Confirmation Report

Main heating Control:

Main heating Control: Time and temperature zone control by device in database

Comments:

Secondary heating system:

Secondary heating system: None

Comments:

Water heating:

Water heating:
Hot water cylinder
Cylinder volume: 250 litres
Cylinder insulation: Measured loss, 1.89kWh/day
Primary pipework insulation: True
Cylinderstat: True
Cylinder in heated space: True

Comments:

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
Low energy lights:	100%
Terrain type:	Dense urban
Wind turbine:	No
Photovoltaics:	None

Comments:

Please provide the MCS certificate or data sheet equivalent confirming the size of the array on the roof. This should include any calculations to support a proportioned amount included in the assessment.

Declaration :

I confirm that the property has been built to the above specification.

Signed:

Developer Confirmation Report

.....

Date:

.....

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 09 June 2022

Property Details: Flat 16 (Baseline)

Dwelling type:	Flat
Located in:	England
Region:	Thames valley
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	True
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	280.48	**(P1)**
Transmission heat loss coefficient:	57.4	
Summer heat loss coefficient:	337.93	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW Glazing 01)	0	1
North West (NW Glazing 02)	0	1
North West (NW Glazing 03)	0	1
North West (NW Glazed Door 01)	0	1
North West (NW Glazed Door 02)	0	1
Horizontal (H Rooflight 01)	0	1
Horizontal (H Rooflight 02)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW Glazing 01)	1	0.9	1	0.9	**(P8)**
North West (NW Glazing 02)	1	0.9	1	0.9	**(P8)**
North West (NW Glazing 03)	1	0.9	1	0.9	**(P8)**
North West (NW Glazed Door 01)	1	0.9	1	0.9	**(P8)**
North West (NW Glazed Door 02)	1	0.9	1	0.9	**(P8)**
Horizontal (H Rooflight 01)	1	1	1	1	**(P8)**
Horizontal (H Rooflight 02)	1	1	1	1	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW Glazing 01)	1 x	2.04	98.85	0.63	0.8	0.9	82.32	
North West (NW Glazing 02)	1 x	2.47	98.85	0.63	0.8	0.9	99.67	
North West (NW Glazing 03)	1 x	2.37	98.85	0.63	0.8	0.9	95.64	
North West (NW Glazed Door 01)	1 x	2.04	98.85	0.63	0.8	0.9	82.32	
North West (NW Glazed Door 02)	1 x	3.81	98.85	0.63	0.8	0.9	153.74	
	1 x	1.1	203	0.63	0.8	1	101.29	
	1 x	0.76	203	0.63	0.8	1	70.44	
						Total	685.42	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	408.25	393.68	400.64	
Total summer gains	1146.37	1079.1	967.25	**(P5)**

SAP 2012 Overheating Assessment

Summer gain/loss ratio	3.39	3.19	2.86	**(P6)**
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	19.64	21.34	20.91	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

Predicted Energy Assessment

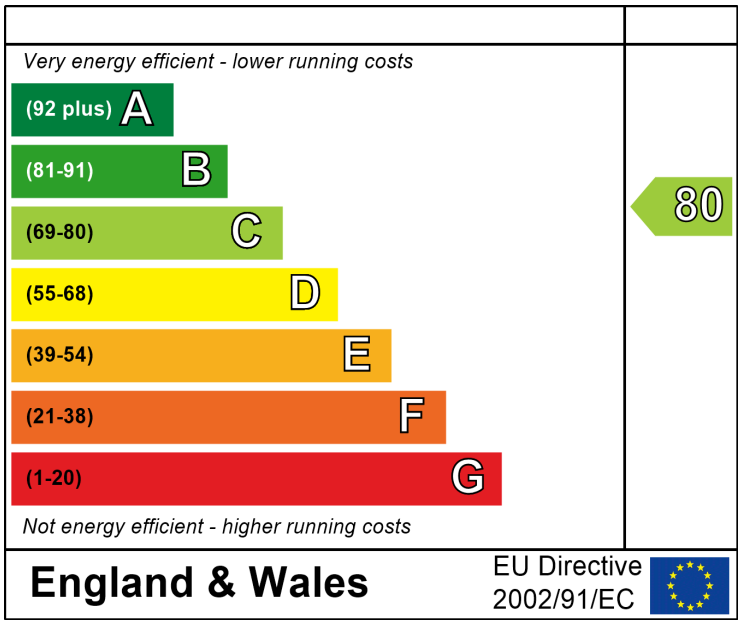
Flat 16
11-12 Market Place
READING
RG1 2EG

Dwelling type: Top floor Flat
Date of assessment: 06 June 2022
Produced by: Michael Langley
Total floor area: 60.71 m²

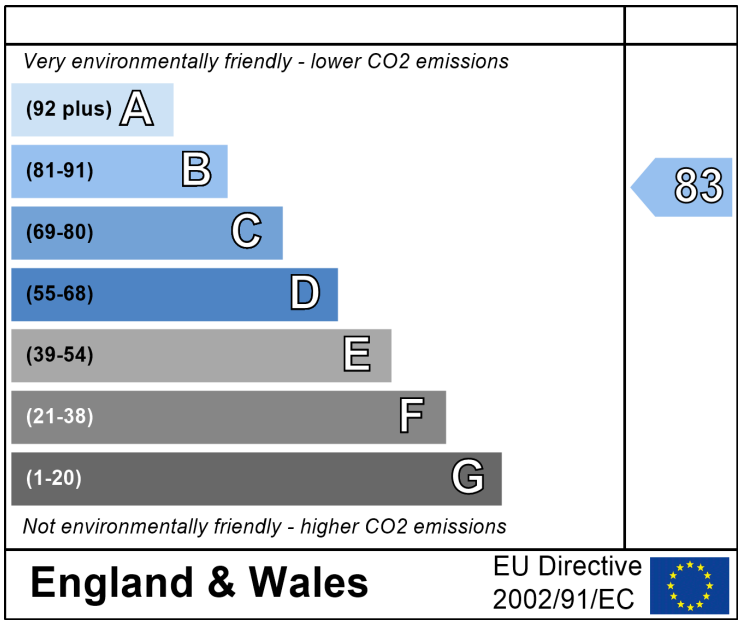
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



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

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Michael Langley	**Stroma Number:**	STRO036755
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: Flat 16 (Baseline)

Address : Flat 16, 11-12 Market Place, READING, RG1 2EG

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	60.71	(1a) x	3.5	(2a) =	212.48	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	60.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		212.48	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	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 and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.09	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.96999979019165	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.34	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(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 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DFEE WorkSheet: New dwelling design stage

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

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

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

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 2			2.47	x1/[1/(1.4)+ 0.04]		=	3.27			(27)
Windows Type 3			2.37	x1/[1/(1.4)+ 0.04]		=	3.14			(27)
Windows Type 4			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 5			3.81	x1/[1/(1.4)+ 0.04]		=	5.05			(27)
Rooflights Type 1			1.1	x1/[1/(1.4) + 0.04]		=	1.54			(27b)
Rooflights Type 2			0.765	x1/[1/(1.4) + 0.04]		=	1.071			(27b)
Walls	76.51	12.73	63.78	x	0.18	=	11.48			(29)
Roof	60.71	1.87	58.84	x	0.13	=	7.65			(30)
Total area of elements, m²			137.22							(31)
Party wall			55.51	x	0	=	0			(32)
Party floor			60.71							(32a)
Internal wall **			168.16							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.48 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6155.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 18.97 (36)

DFEE WorkSheet: New dwelling design stage

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 57.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.78	40.56	40.34	39.32	39.13	38.24	38.24	38.07	38.58	39.13	39.52	39.92	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	98.23	98.01	97.79	96.77	96.58	95.69	95.69	95.52	96.03	96.58	96.97	97.37

Average = Sum(39)$_{1...12}$ /12= 96.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.62	1.61	1.61	1.59	1.59	1.58	1.58	1.57	1.58	1.59	1.6	1.6

Average = Sum(40)$_{1...12}$ /12= 1.59 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 81.74 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	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)

(44)m=	89.91	86.64	83.37	80.1	76.83	73.56	73.56	76.83	80.1	83.37	86.64	89.91

Total = Sum(44)$_{1...12}$ = 980.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	133.34	116.62	120.34	104.91	100.67	86.87	80.5	92.37	93.47	108.94	118.91	129.13

Total = Sum(45)$_{1...12}$ = 1286.07 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 250 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

DFEE WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	113.34	99.13	102.29	89.18	85.57	73.84	68.42	78.52	79.45	92.6	101.08	109.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	113.34	99.13	102.29	89.18	85.57	73.84	68.42	78.52	79.45	92.6	101.08	109.76

Output from water heater (annual)$_{1...12}$ | 1093.16 | (64)

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

(65)m=	28.33	24.78	25.57	22.29	21.39	18.46	17.11	19.63	19.86	23.15	25.27	27.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	(66)

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

(67)m=	15.58	13.84	11.25	8.52	6.37	5.38	5.81	7.55	10.13	12.87	15.02	16.01	(67)

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

(68)m=	174.73	176.55	171.98	162.25	149.97	138.43	130.72	128.91	133.48	143.2	155.48	167.02	(68)

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

(69)m=	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	(71)

Water heating gains (Table 5)

(72)m=	38.08	36.88	34.37	30.96	28.75	25.64	22.99	26.38	27.59	31.11	35.1	36.88	(72)

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

(73)m=	281.42	280.28	270.63	254.76	238.12	222.47	212.55	215.87	224.22	240.21	258.62	272.94	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	2.04	x	11.28	x	0.63	x	0.8	=	8.04	(81)
Northwest 0.9x	0.77	x	2.47	x	11.28	x	0.63	x	0.8	=	9.73	(81)
Northwest 0.9x	0.77	x	2.37	x	11.28	x	0.63	x	0.8	=	9.34	(81)
Northwest 0.9x	0.77	x	2.04	x	11.28	x	0.63	x	0.8	=	8.04	(81)
Northwest 0.9x	0.77	x	3.81	x	11.28	x	0.63	x	0.8	=	15.01	(81)
Northwest 0.9x	0.77	x	2.04	x	22.97	x	0.63	x	0.8	=	16.36	(81)
Northwest 0.9x	0.77	x	2.47	x	22.97	x	0.63	x	0.8	=	19.81	(81)
Northwest 0.9x	0.77	x	2.37	x	22.97	x	0.63	x	0.8	=	19.01	(81)
Northwest 0.9x	0.77	x	2.04	x	22.97	x	0.63	x	0.8	=	16.36	(81)
Northwest 0.9x	0.77	x	3.81	x	22.97	x	0.63	x	0.8	=	30.56	(81)
Northwest 0.9x	0.77	x	2.04	x	41.38	x	0.63	x	0.8	=	29.48	(81)
Northwest 0.9x	0.77	x	2.47	x	41.38	x	0.63	x	0.8	=	35.7	(81)
Northwest 0.9x	0.77	x	2.37	x	41.38	x	0.63	x	0.8	=	34.25	(81)
Northwest 0.9x	0.77	x	2.04	x	41.38	x	0.63	x	0.8	=	29.48	(81)
Northwest 0.9x	0.77	x	3.81	x	41.38	x	0.63	x	0.8	=	55.06	(81)
Northwest 0.9x	0.77	x	2.04	x	67.96	x	0.63	x	0.8	=	48.42	(81)
Northwest 0.9x	0.77	x	2.47	x	67.96	x	0.63	x	0.8	=	58.63	(81)
Northwest 0.9x	0.77	x	2.37	x	67.96	x	0.63	x	0.8	=	56.25	(81)
Northwest 0.9x	0.77	x	2.04	x	67.96	x	0.63	x	0.8	=	48.42	(81)
Northwest 0.9x	0.77	x	3.81	x	67.96	x	0.63	x	0.8	=	90.43	(81)
Northwest 0.9x	0.77	x	2.04	x	91.35	x	0.63	x	0.8	=	65.09	(81)
Northwest 0.9x	0.77	x	2.47	x	91.35	x	0.63	x	0.8	=	78.8	(81)
Northwest 0.9x	0.77	x	2.37	x	91.35	x	0.63	x	0.8	=	75.61	(81)
Northwest 0.9x	0.77	x	2.04	x	91.35	x	0.63	x	0.8	=	65.09	(81)
Northwest 0.9x	0.77	x	3.81	x	91.35	x	0.63	x	0.8	=	121.56	(81)
Northwest 0.9x	0.77	x	2.04	x	97.38	x	0.63	x	0.8	=	69.39	(81)
Northwest 0.9x	0.77	x	2.47	x	97.38	x	0.63	x	0.8	=	84.01	(81)
Northwest 0.9x	0.77	x	2.37	x	97.38	x	0.63	x	0.8	=	80.61	(81)
Northwest 0.9x	0.77	x	2.04	x	97.38	x	0.63	x	0.8	=	69.39	(81)
Northwest 0.9x	0.77	x	3.81	x	97.38	x	0.63	x	0.8	=	129.59	(81)
Northwest 0.9x	0.77	x	2.04	x	91.1	x	0.63	x	0.8	=	64.91	(81)
Northwest 0.9x	0.77	x	2.47	x	91.1	x	0.63	x	0.8	=	78.59	(81)
Northwest 0.9x	0.77	x	2.37	x	91.1	x	0.63	x	0.8	=	75.41	(81)
Northwest 0.9x	0.77	x	2.04	x	91.1	x	0.63	x	0.8	=	64.91	(81)
Northwest 0.9x	0.77	x	3.81	x	91.1	x	0.63	x	0.8	=	121.23	(81)
Northwest 0.9x	0.77	x	2.04	x	72.63	x	0.63	x	0.8	=	51.75	(81)
Northwest 0.9x	0.77	x	2.47	x	72.63	x	0.63	x	0.8	=	62.66	(81)
Northwest 0.9x	0.77	x	2.37	x	72.63	x	0.63	x	0.8	=	60.12	(81)
Northwest 0.9x	0.77	x	2.04	x	72.63	x	0.63	x	0.8	=	51.75	(81)

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Northwest 0.9x	0.77	x	3.81	x	72.63	x	0.63	x	0.8	=	96.65	(81)
Northwest 0.9x	0.77	x	2.04	x	50.42	x	0.63	x	0.8	=	35.93	(81)
Northwest 0.9x	0.77	x	2.47	x	50.42	x	0.63	x	0.8	=	43.5	(81)
Northwest 0.9x	0.77	x	2.37	x	50.42	x	0.63	x	0.8	=	41.74	(81)
Northwest 0.9x	0.77	x	2.04	x	50.42	x	0.63	x	0.8	=	35.93	(81)
Northwest 0.9x	0.77	x	3.81	x	50.42	x	0.63	x	0.8	=	67.1	(81)
Northwest 0.9x	0.77	x	2.04	x	28.07	x	0.63	x	0.8	=	20	(81)
Northwest 0.9x	0.77	x	2.47	x	28.07	x	0.63	x	0.8	=	24.21	(81)
Northwest 0.9x	0.77	x	2.37	x	28.07	x	0.63	x	0.8	=	23.23	(81)
Northwest 0.9x	0.77	x	2.04	x	28.07	x	0.63	x	0.8	=	20	(81)
Northwest 0.9x	0.77	x	3.81	x	28.07	x	0.63	x	0.8	=	37.35	(81)
Northwest 0.9x	0.77	x	2.04	x	14.2	x	0.63	x	0.8	=	10.12	(81)
Northwest 0.9x	0.77	x	2.47	x	14.2	x	0.63	x	0.8	=	12.25	(81)
Northwest 0.9x	0.77	x	2.37	x	14.2	x	0.63	x	0.8	=	11.75	(81)
Northwest 0.9x	0.77	x	2.04	x	14.2	x	0.63	x	0.8	=	10.12	(81)
Northwest 0.9x	0.77	x	3.81	x	14.2	x	0.63	x	0.8	=	18.89	(81)
Northwest 0.9x	0.77	x	2.04	x	9.21	x	0.63	x	0.8	=	6.57	(81)
Northwest 0.9x	0.77	x	2.47	x	9.21	x	0.63	x	0.8	=	7.95	(81)
Northwest 0.9x	0.77	x	2.37	x	9.21	x	0.63	x	0.8	=	7.63	(81)
Northwest 0.9x	0.77	x	2.04	x	9.21	x	0.63	x	0.8	=	6.57	(81)
Northwest 0.9x	0.77	x	3.81	x	9.21	x	0.63	x	0.8	=	12.26	(81)
Rooflights 0.9x	1	x	1.1	x	26	x	0.63	x	0.8	=	12.97	(82)
Rooflights 0.9x	1	x	0.76	x	26	x	0.63	x	0.8	=	9.02	(82)
Rooflights 0.9x	1	x	1.1	x	54	x	0.63	x	0.8	=	26.94	(82)
Rooflights 0.9x	1	x	0.76	x	54	x	0.63	x	0.8	=	18.74	(82)
Rooflights 0.9x	1	x	1.1	x	96	x	0.63	x	0.8	=	47.9	(82)
Rooflights 0.9x	1	x	0.76	x	96	x	0.63	x	0.8	=	33.31	(82)
Rooflights 0.9x	1	x	1.1	x	150	x	0.63	x	0.8	=	74.84	(82)
Rooflights 0.9x	1	x	0.76	x	150	x	0.63	x	0.8	=	52.05	(82)
Rooflights 0.9x	1	x	1.1	x	192	x	0.63	x	0.8	=	95.8	(82)
Rooflights 0.9x	1	x	0.76	x	192	x	0.63	x	0.8	=	66.62	(82)
Rooflights 0.9x	1	x	1.1	x	200	x	0.63	x	0.8	=	99.79	(82)
Rooflights 0.9x	1	x	0.76	x	200	x	0.63	x	0.8	=	69.4	(82)
Rooflights 0.9x	1	x	1.1	x	189	x	0.63	x	0.8	=	94.3	(82)
Rooflights 0.9x	1	x	0.76	x	189	x	0.63	x	0.8	=	65.58	(82)
Rooflights 0.9x	1	x	1.1	x	157	x	0.63	x	0.8	=	78.34	(82)
Rooflights 0.9x	1	x	0.76	x	157	x	0.63	x	0.8	=	54.48	(82)
Rooflights 0.9x	1	x	1.1	x	115	x	0.63	x	0.8	=	57.38	(82)
Rooflights 0.9x	1	x	0.76	x	115	x	0.63	x	0.8	=	39.91	(82)
Rooflights 0.9x	1	x	1.1	x	66	x	0.63	x	0.8	=	32.93	(82)
Rooflights 0.9x	1	x	0.76	x	66	x	0.63	x	0.8	=	22.9	(82)

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Rooflights 0.9x	1	x	1.1	x	33	x	0.63	x	0.8	=	16.47	(82)
Rooflights 0.9x	1	x	0.76	x	33	x	0.63	x	0.8	=	11.45	(82)
Rooflights 0.9x	1	x	1.1	x	21	x	0.63	x	0.8	=	10.48	(82)
Rooflights 0.9x	1	x	0.76	x	21	x	0.63	x	0.8	=	7.29	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	72.16	147.8	265.19	429.04	568.57	602.19	564.94	455.73	321.47	180.63	91.04	58.73	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	353.58	428.08	535.82	683.8	806.69	824.66	777.49	671.6	545.69	420.84	349.66	331.68	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.84	0.67	0.52	0.61	0.87	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.16	19.36	19.73	20.25	20.68	20.91	20.97	20.95	20.73	20.15	19.57	19.14	(87)

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

(88)m=	19.6	19.6	19.61	19.62	19.62	19.63	19.63	19.63	19.63	19.62	19.62	19.61	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.77	0.55	0.37	0.45	0.79	0.97	0.99	1	(89)

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

(90)m=	17.96	18.15	18.53	19.04	19.42	19.59	19.63	19.62	19.48	18.96	18.38	17.94	(90)

fLA = Living area ÷ (4) = 0.31 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.33	18.53	18.9	19.41	19.81	20	20.04	20.03	19.87	19.33	18.75	18.31	(92)

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

(93)m=	18.33	18.53	18.9	19.41	19.81	20	20.04	20.03	19.87	19.33	18.75	18.31	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.78	0.59	0.42	0.5	0.8	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	352.2	424.5	522.93	628.35	632.75	482.68	322.79	334.08	438.06	406.42	347.15	330.67	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1378.41	1335.44	1212.38	1017.14	783.13	516.68	329.33	346.99	553.66	842.72	1129.19	1373.77	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	763.5	612.15	512.95	279.93	111.89	0	0	0	0	324.61	563.06	776.07	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3944.15 (98)

Space heating requirement in kWh/m²/year 64.97 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	899.46	708.08	725.97	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.84	0.9	0.85	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	756.34	635.03	617.16	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1010.03	955	836.96	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m

set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	182.65	238.06	163.53	0	0	0	0

Total = Sum(104) = 584.24 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	45.66	59.51	40.88	0	0	0	0

Total = Sum(107) = 146.06 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 2.41 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency — (99) + (108) = 67.37 (109)

SAP Input

Property Details: Flat 16 (Baseline)

Address:	Flat 16, 11-12 Market Place, READING, RG1 2EG
Located in:	England
Region:	Thames valley
UPRN:	UPRN-000310041680
Date of assessment:	06 June 2022
Date of certificate:	09 June 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	497

Property description:

Dwelling type:	Flat	
Detachment:		
Year Completed:	2022	
Floor Location:	Floor area:	Storey height:
Floor 0	60.71 m²	3.5 m
Living area:	18.74 m² (fraction 0.309)	
Front of dwelling faces:	East	

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW Glazing 01	Manufacturer	Windows	double-glazed	No	
NW Glazing 02	Manufacturer	Windows	double-glazed	No	
NW Glazing 03	Manufacturer	Windows	double-glazed	No	
NW Glazed Door 01	Manufacturer	Windows	double-glazed	No	
NW Glazed Door 02	Manufacturer	Windows	double-glazed	No	
H Rooflight 01	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	No	Metal
H Rooflight 02	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	No	Metal

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW Glazing 01	16mm or more	0.8	0.63	1.4	2.04	1
NW Glazing 02	16mm or more	0.8	0.63	1.4	2.47	1
NW Glazing 03	16mm or more	0.8	0.63	1.4	2.37	1
NW Glazed Door 01	16mm or more	0.8	0.63	1.4	2.04	1
NW Glazed Door 02	16mm or more	0.8	0.63	1.4	3.81	1
H Rooflight 01	16mm or more	0.8	0.63	1.4	1.1	1
H Rooflight 02	16mm or more	0.8	0.63	1.4	0.765	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW Glazing 01		External Improved Brick Cavity Walls	North West	0.95	2.15
NW Glazing 02		External Improved Brick Cavity Walls	North West	1.15	2.15
NW Glazing 03		External Improved Brick Cavity Walls	North West	1.1	2.15
NW Glazed Door 01		External Improved Brick Cavity Walls	North West	0.95	2.15
NW Glazed Door 02		External Improved Brick Cavity Walls	North West	1.77	2.15
H Rooflight 01		External Improved Flat Roofs	Horizontal	1.05	1.05
H Rooflight 02		External Improved Flat Roofs	Horizontal	0.9	0.85

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:

SAP Input

External Elements							
External Improved Brick Cavity Walls	76.51	12.73	63.78	0.18	0	False	N/A
External Improved Flat Roofs	60.71	1.87	58.84	0.13	0		N/A
Internal Elements							
Internal Stud Walls	168.16						N/A
Party Elements							
Party Stud Walls	55.51						N/A
Party Plank Floors	60.71						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1382

Length	Psi-value		
5.92	0.05	E2	Other lintels (including other steel lintels)
5.92	0.05	E3	Sill
21.5	0.05	E4	Jamb
21.86	0.07	E7	Party floor between dwellings (in blocks of flats)
21.86	0.56	E15	Flat roof with parapet
7	0.09	E16	Corner (normal)
7	0.06	E18	Party wall between dwellings
15.86	0	P3	Intermediate floor between dwellings (in blocks of flats)
15.86	0.12	P4	Roof (insulation at ceiling level)
1.95	0.08	R1	Head
1.95	0.06	R2	Sill
3.8	0.08	R3	Jamb

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	2
Number of passive stacks:	0
Number of sides sheltered:	1
Pressure test:	4.97

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Manufacturer Declaration
Manufacturer's data
Efficiency: 89.5% (SEDBUK2009)
Regular condensing with automatic ignition
Fuel Burning Type: Modulation
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Room-sealed
Boiler interlock: Yes

Main heating Control:

Main heating Control:

Time and temperature zone control by device in database
Control code: 2112

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system

SAP Input

Water code: 901
Fuel :mains gas
Hot water cylinder
Cylinder volume: 250 litres
Cylinder insulation: Measured loss, 1.89kWh/day
Primary pipework insulation: True
Cylinderstat: True
Cylinder in heated space: True
Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Michael Langley	**Stroma Number:**	STRO036755
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: Flat 16 (Baseline)

Address : Flat 16, 11-12 Market Place, READING, RG1 2EG

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	60.71	(1a) x	3.5	(2a) =	212.48	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	60.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		212.48	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	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 and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.09	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.34	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(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 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

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

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 2			2.47	x1/[1/(1.4)+ 0.04]		=	3.27			(27)
Windows Type 3			2.37	x1/[1/(1.4)+ 0.04]		=	3.14			(27)
Windows Type 4			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 5			3.81	x1/[1/(1.4)+ 0.04]		=	5.05			(27)
Rooflights Type 1			1.1	x1/[1/(1.7) + 0.04]		=	1.87			(27b)
Rooflights Type 2			0.765	x1/[1/(1.7) + 0.04]		=	1.3005			(27b)
Walls	76.51	12.73	63.78	x	0.18	=	11.48			(29)
Roof	60.71	1.87	58.84	x	0.13	=	7.65			(30)
Total area of elements, m²			137.22							(31)
Party wall			55.51	x	0	=	0			(32)
Party floor			60.71							(32a)
Internal wall **			168.16							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6155.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 18.97 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 57.94 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.83	40.61	40.39	39.36	39.17	38.27	38.27	38.1	38.61	39.17	39.56	39.96	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	98.78	98.56	98.34	97.3	97.11	96.21	96.21	96.04	96.56	97.11	97.5	97.91

Average = Sum(39)$_{1...12}$ /12= 97.3 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.63	1.62	1.62	1.6	1.6	1.58	1.58	1.58	1.59	1.6	1.61	1.61

Average = Sum(40)$_{1...12}$ /12= 1.6 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 81.74 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	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)

(44)m=	89.91	86.64	83.37	80.1	76.83	73.56	73.56	76.83	80.1	83.37	86.64	89.91

Total = Sum(44)$_{1...12}$ = 980.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	133.34	116.62	120.34	104.91	100.67	86.87	80.5	92.37	93.47	108.94	118.91	129.13

Total = Sum(45)$_{1...12}$ = 1286.07 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	113.34	99.13	102.29	89.18	85.57	73.84	68.42	78.52	79.45	92.6	101.08	109.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	113.34	99.13	102.29	89.18	85.57	73.84	68.42	78.52	79.45	92.6	101.08	109.76

Output from water heater (annual)$_{1...12}$ | 1093.16 | (64)

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

(65)m=	28.33	24.78	25.57	22.29	21.39	18.46	17.11	19.63	19.86	23.15	25.27	27.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	(66)

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

(67)m=	15.58	13.84	11.25	8.52	6.37	5.38	5.81	7.55	10.13	12.87	15.02	16.01	(67)

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

(68)m=	174.73	176.55	171.98	162.25	149.97	138.43	130.72	128.91	133.48	143.2	155.48	167.02	(68)

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

(69)m=	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	(71)

Water heating gains (Table 5)

(72)m=	38.08	36.88	34.37	30.96	28.75	25.64	22.99	26.38	27.59	31.11	35.1	36.88	(72)

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

(73)m=	281.42	280.28	270.63	254.76	238.12	222.47	212.55	215.87	224.22	240.21	258.62	272.94	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	2.04	x	11.28	x	0.63	x	0.7	=	7.03	(81)
Northwest 0.9x	0.77	x	2.47	x	11.28	x	0.63	x	0.7	=	8.52	(81)
Northwest 0.9x	0.77	x	2.37	x	11.28	x	0.63	x	0.7	=	8.17	(81)
Northwest 0.9x	0.77	x	2.04	x	11.28	x	0.63	x	0.7	=	7.03	(81)
Northwest 0.9x	0.77	x	3.81	x	11.28	x	0.63	x	0.7	=	13.14	(81)
Northwest 0.9x	0.77	x	2.04	x	22.97	x	0.63	x	0.7	=	14.32	(81)
Northwest 0.9x	0.77	x	2.47	x	22.97	x	0.63	x	0.7	=	17.34	(81)
Northwest 0.9x	0.77	x	2.37	x	22.97	x	0.63	x	0.7	=	16.63	(81)
Northwest 0.9x	0.77	x	2.04	x	22.97	x	0.63	x	0.7	=	14.32	(81)
Northwest 0.9x	0.77	x	3.81	x	22.97	x	0.63	x	0.7	=	26.74	(81)
Northwest 0.9x	0.77	x	2.04	x	41.38	x	0.63	x	0.7	=	25.8	(81)
Northwest 0.9x	0.77	x	2.47	x	41.38	x	0.63	x	0.7	=	31.24	(81)
Northwest 0.9x	0.77	x	2.37	x	41.38	x	0.63	x	0.7	=	29.97	(81)
Northwest 0.9x	0.77	x	2.04	x	41.38	x	0.63	x	0.7	=	25.8	(81)
Northwest 0.9x	0.77	x	3.81	x	41.38	x	0.63	x	0.7	=	48.18	(81)
Northwest 0.9x	0.77	x	2.04	x	67.96	x	0.63	x	0.7	=	42.37	(81)
Northwest 0.9x	0.77	x	2.47	x	67.96	x	0.63	x	0.7	=	51.3	(81)
Northwest 0.9x	0.77	x	2.37	x	67.96	x	0.63	x	0.7	=	49.22	(81)
Northwest 0.9x	0.77	x	2.04	x	67.96	x	0.63	x	0.7	=	42.37	(81)
Northwest 0.9x	0.77	x	3.81	x	67.96	x	0.63	x	0.7	=	79.13	(81)
Northwest 0.9x	0.77	x	2.04	x	91.35	x	0.63	x	0.7	=	56.95	(81)
Northwest 0.9x	0.77	x	2.47	x	91.35	x	0.63	x	0.7	=	68.95	(81)
Northwest 0.9x	0.77	x	2.37	x	91.35	x	0.63	x	0.7	=	66.16	(81)
Northwest 0.9x	0.77	x	2.04	x	91.35	x	0.63	x	0.7	=	56.95	(81)
Northwest 0.9x	0.77	x	3.81	x	91.35	x	0.63	x	0.7	=	106.36	(81)
Northwest 0.9x	0.77	x	2.04	x	97.38	x	0.63	x	0.7	=	60.71	(81)
Northwest 0.9x	0.77	x	2.47	x	97.38	x	0.63	x	0.7	=	73.51	(81)
Northwest 0.9x	0.77	x	2.37	x	97.38	x	0.63	x	0.7	=	70.54	(81)
Northwest 0.9x	0.77	x	2.04	x	97.38	x	0.63	x	0.7	=	60.71	(81)
Northwest 0.9x	0.77	x	3.81	x	97.38	x	0.63	x	0.7	=	113.39	(81)
Northwest 0.9x	0.77	x	2.04	x	91.1	x	0.63	x	0.7	=	56.8	(81)
Northwest 0.9x	0.77	x	2.47	x	91.1	x	0.63	x	0.7	=	68.77	(81)
Northwest 0.9x	0.77	x	2.37	x	91.1	x	0.63	x	0.7	=	65.98	(81)
Northwest 0.9x	0.77	x	2.04	x	91.1	x	0.63	x	0.7	=	56.8	(81)
Northwest 0.9x	0.77	x	3.81	x	91.1	x	0.63	x	0.7	=	106.08	(81)
Northwest 0.9x	0.77	x	2.04	x	72.63	x	0.63	x	0.7	=	45.28	(81)
Northwest 0.9x	0.77	x	2.47	x	72.63	x	0.63	x	0.7	=	54.82	(81)
Northwest 0.9x	0.77	x	2.37	x	72.63	x	0.63	x	0.7	=	52.6	(81)
Northwest 0.9x	0.77	x	2.04	x	72.63	x	0.63	x	0.7	=	45.28	(81)

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Northwest 0.9x	0.77	x	3.81	x	72.63	x	0.63	x	0.7	=	84.57	(81)
Northwest 0.9x	0.77	x	2.04	x	50.42	x	0.63	x	0.7	=	31.43	(81)
Northwest 0.9x	0.77	x	2.47	x	50.42	x	0.63	x	0.7	=	38.06	(81)
Northwest 0.9x	0.77	x	2.37	x	50.42	x	0.63	x	0.7	=	36.52	(81)
Northwest 0.9x	0.77	x	2.04	x	50.42	x	0.63	x	0.7	=	31.43	(81)
Northwest 0.9x	0.77	x	3.81	x	50.42	x	0.63	x	0.7	=	58.71	(81)
Northwest 0.9x	0.77	x	2.04	x	28.07	x	0.63	x	0.7	=	17.5	(81)
Northwest 0.9x	0.77	x	2.47	x	28.07	x	0.63	x	0.7	=	21.19	(81)
Northwest 0.9x	0.77	x	2.37	x	28.07	x	0.63	x	0.7	=	20.33	(81)
Northwest 0.9x	0.77	x	2.04	x	28.07	x	0.63	x	0.7	=	17.5	(81)
Northwest 0.9x	0.77	x	3.81	x	28.07	x	0.63	x	0.7	=	32.68	(81)
Northwest 0.9x	0.77	x	2.04	x	14.2	x	0.63	x	0.7	=	8.85	(81)
Northwest 0.9x	0.77	x	2.47	x	14.2	x	0.63	x	0.7	=	10.72	(81)
Northwest 0.9x	0.77	x	2.37	x	14.2	x	0.63	x	0.7	=	10.28	(81)
Northwest 0.9x	0.77	x	2.04	x	14.2	x	0.63	x	0.7	=	8.85	(81)
Northwest 0.9x	0.77	x	3.81	x	14.2	x	0.63	x	0.7	=	16.53	(81)
Northwest 0.9x	0.77	x	2.04	x	9.21	x	0.63	x	0.7	=	5.74	(81)
Northwest 0.9x	0.77	x	2.47	x	9.21	x	0.63	x	0.7	=	6.96	(81)
Northwest 0.9x	0.77	x	2.37	x	9.21	x	0.63	x	0.7	=	6.67	(81)
Northwest 0.9x	0.77	x	2.04	x	9.21	x	0.63	x	0.7	=	5.74	(81)
Northwest 0.9x	0.77	x	3.81	x	9.21	x	0.63	x	0.7	=	10.73	(81)
Rooflights 0.9x	1	x	1.1	x	26	x	0.63	x	0.7	=	11.35	(82)
Rooflights 0.9x	1	x	0.76	x	26	x	0.63	x	0.7	=	7.89	(82)
Rooflights 0.9x	1	x	1.1	x	54	x	0.63	x	0.7	=	23.58	(82)
Rooflights 0.9x	1	x	0.76	x	54	x	0.63	x	0.7	=	16.4	(82)
Rooflights 0.9x	1	x	1.1	x	96	x	0.63	x	0.7	=	41.91	(82)
Rooflights 0.9x	1	x	0.76	x	96	x	0.63	x	0.7	=	29.15	(82)
Rooflights 0.9x	1	x	1.1	x	150	x	0.63	x	0.7	=	65.49	(82)
Rooflights 0.9x	1	x	0.76	x	150	x	0.63	x	0.7	=	45.54	(82)
Rooflights 0.9x	1	x	1.1	x	192	x	0.63	x	0.7	=	83.83	(82)
Rooflights 0.9x	1	x	0.76	x	192	x	0.63	x	0.7	=	58.3	(82)
Rooflights 0.9x	1	x	1.1	x	200	x	0.63	x	0.7	=	87.32	(82)
Rooflights 0.9x	1	x	0.76	x	200	x	0.63	x	0.7	=	60.73	(82)
Rooflights 0.9x	1	x	1.1	x	189	x	0.63	x	0.7	=	82.52	(82)
Rooflights 0.9x	1	x	0.76	x	189	x	0.63	x	0.7	=	57.39	(82)
Rooflights 0.9x	1	x	1.1	x	157	x	0.63	x	0.7	=	68.54	(82)
Rooflights 0.9x	1	x	0.76	x	157	x	0.63	x	0.7	=	47.67	(82)
Rooflights 0.9x	1	x	1.1	x	115	x	0.63	x	0.7	=	50.21	(82)
Rooflights 0.9x	1	x	0.76	x	115	x	0.63	x	0.7	=	34.92	(82)
Rooflights 0.9x	1	x	1.1	x	66	x	0.63	x	0.7	=	28.81	(82)
Rooflights 0.9x	1	x	0.76	x	66	x	0.63	x	0.7	=	20.04	(82)

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Rooflights 0.9x	1	x	1.1	x	33	x	0.63	x	0.7	=	14.41	(82)
Rooflights 0.9x	1	x	0.76	x	33	x	0.63	x	0.7	=	10.02	(82)
Rooflights 0.9x	1	x	1.1	x	21	x	0.63	x	0.7	=	9.17	(82)
Rooflights 0.9x	1	x	0.76	x	21	x	0.63	x	0.7	=	6.38	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	63.14	129.32	232.04	375.41	497.5	526.91	494.33	398.77	281.28	158.05	79.66	51.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	344.56	409.61	502.67	630.17	735.62	749.38	706.87	614.63	505.51	398.26	338.28	324.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.87	0.71	0.56	0.65	0.89	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.14	19.32	19.68	20.18	20.62	20.88	20.96	20.94	20.69	20.12	19.55	19.12	(87)

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

(88)m=	19.59	19.6	19.6	19.61	19.61	19.62	19.62	19.63	19.62	19.61	19.61	19.6	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.81	0.6	0.4	0.49	0.82	0.97	1	1	(89)

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

(90)m=	17.93	18.11	18.47	18.97	19.37	19.57	19.62	19.61	19.45	18.92	18.35	17.91	(90)

fLA = Living area ÷ (4) = 0.31 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.31	18.49	18.84	19.34	19.76	19.98	20.03	20.02	19.83	19.29	18.72	18.28	(92)

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

(93)m=	18.31	18.49	18.84	19.34	19.76	19.98	20.03	20.02	19.83	19.29	18.72	18.28	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.82	0.63	0.45	0.54	0.83	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	343.33	406.63	492.71	588.81	602.78	472.75	321.16	330.6	419.96	386.66	336.1	323.42	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1383.48	1339.01	1213.55	1015.99	782.34	517.46	330.28	347.78	553.43	843.59	1132.72	1379.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	773.88	626.56	536.3	307.57	133.59	0	0	0	0	339.96	573.56	785.38	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4076.8 (98)

Space heating requirement in kWh/m²/year 67.15 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	904.38	711.96	729.94	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.81	0.87	0.82	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	728.88	619.47	598.02	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	925.61	875.83	773.17	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	141.65	190.73	130.31	0	0	0	0

Total = Sum(104) = 462.7 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	35.41	47.68	32.58	0	0	0	0

Total = Sum(107) = 115.67 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 1.91 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency — (99) + (108) = 69.06 (109)

Target Fabric Energy Efficiency (TFEE) 79.42 (109)

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User Details:

Assessor Name:	Michael Langley	**Stroma Number:**	STRO036755
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: Flat 16 (Baseline)

Address : Flat 16, 11-12 Market Place, READING, RG1 2EG

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	60.71	(1a) x	3.5	(2a) =	212.48	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	60.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		212.48	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	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 and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.09	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.96999979019165	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.34	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(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 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

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

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 2			2.47	x1/[1/(1.4)+ 0.04]		=	3.27			(27)
Windows Type 3			2.37	x1/[1/(1.4)+ 0.04]		=	3.14			(27)
Windows Type 4			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 5			3.81	x1/[1/(1.4)+ 0.04]		=	5.05			(27)
Rooflights Type 1			1.1	x1/[1/(1.4) + 0.04]		=	1.54			(27b)
Rooflights Type 2			0.765	x1/[1/(1.4) + 0.04]		=	1.071			(27b)
Walls	76.51	12.73	63.78	x	0.18	=	11.48			(29)
Roof	60.71	1.87	58.84	x	0.13	=	7.65			(30)
Total area of elements, m²			137.22							(31)
Party wall			55.51	x	0	=	0			(32)
Party floor			60.71							(32a)
Internal wall **			168.16							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.48 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6155.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 18.97 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 57.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.78	40.56	40.34	39.32	39.13	38.24	38.24	38.07	38.58	39.13	39.52	39.92	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	98.23	98.01	97.79	96.77	96.58	95.69	95.69	95.52	96.03	96.58	96.97	97.37

Average = Sum(39)$_{1...12}$ /12= 96.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.62	1.61	1.61	1.59	1.59	1.58	1.58	1.57	1.58	1.59	1.6	1.6

Average = Sum(40)$_{1...12}$ /12= 1.59 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 81.74 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	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)

(44)m=	89.91	86.64	83.37	80.1	76.83	73.56	73.56	76.83	80.1	83.37	86.64	89.91

Total = Sum(44)$_{1...12}$ = 980.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	133.34	116.62	120.34	104.91	100.67	86.87	80.5	92.37	93.47	108.94	118.91	129.13

Total = Sum(45)$_{1...12}$ = 1286.07 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20	17.49	18.05	15.74	15.1	13.03	12.07	13.86	14.02	16.34	17.84	19.37	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 250 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.89 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.02 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 1.02 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	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 calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.24	166.21	175.24	158.04	155.57	140	135.4	147.27	146.6	163.84	172.04	184.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.24	166.21	175.24	158.04	155.57	140	135.4	147.27	146.6	163.84	172.04	184.03

Output from water heater (annual)$_{1...12}$ | 1932.49 | (64)

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

(65)m=	88.26	78.45	83.93	77.39	77.39	71.39	70.69	74.63	73.58	80.14	82.04	86.86	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.1	120.1	120.1	120.1	120.1	120.1	120.1	120.1	120.1	120.1	120.1	120.1	(66)

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

(67)m=	38.94	34.59	28.13	21.3	15.92	13.44	14.52	18.88	25.34	32.17	37.55	40.03	(67)

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

(68)m=	260.8	263.5	256.68	242.17	223.84	206.61	195.11	192.4	199.22	213.74	232.07	249.29	(68)

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

(69)m=	49.01	49.01	49.01	49.01	49.01	49.01	49.01	49.01	49.01	49.01	49.01	49.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	(71)

Water heating gains (Table 5)

(72)m=	118.62	116.74	112.81	107.48	104.02	99.15	95.01	100.31	102.2	107.72	113.95	116.74	(72)

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

(73)m=	510.41	506.87	489.67	462.99	435.82	411.25	396.68	403.64	418.8	445.67	475.6	498.1	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	2.04	x	11.28	x	0.63	x	0.8	=	8.04	(81)
Northwest 0.9x	0.77	x	2.47	x	11.28	x	0.63	x	0.8	=	9.73	(81)
Northwest 0.9x	0.77	x	2.37	x	11.28	x	0.63	x	0.8	=	9.34	(81)
Northwest 0.9x	0.77	x	2.04	x	11.28	x	0.63	x	0.8	=	8.04	(81)
Northwest 0.9x	0.77	x	3.81	x	11.28	x	0.63	x	0.8	=	15.01	(81)
Northwest 0.9x	0.77	x	2.04	x	22.97	x	0.63	x	0.8	=	16.36	(81)
Northwest 0.9x	0.77	x	2.47	x	22.97	x	0.63	x	0.8	=	19.81	(81)
Northwest 0.9x	0.77	x	2.37	x	22.97	x	0.63	x	0.8	=	19.01	(81)
Northwest 0.9x	0.77	x	2.04	x	22.97	x	0.63	x	0.8	=	16.36	(81)
Northwest 0.9x	0.77	x	3.81	x	22.97	x	0.63	x	0.8	=	30.56	(81)
Northwest 0.9x	0.77	x	2.04	x	41.38	x	0.63	x	0.8	=	29.48	(81)
Northwest 0.9x	0.77	x	2.47	x	41.38	x	0.63	x	0.8	=	35.7	(81)
Northwest 0.9x	0.77	x	2.37	x	41.38	x	0.63	x	0.8	=	34.25	(81)
Northwest 0.9x	0.77	x	2.04	x	41.38	x	0.63	x	0.8	=	29.48	(81)
Northwest 0.9x	0.77	x	3.81	x	41.38	x	0.63	x	0.8	=	55.06	(81)
Northwest 0.9x	0.77	x	2.04	x	67.96	x	0.63	x	0.8	=	48.42	(81)
Northwest 0.9x	0.77	x	2.47	x	67.96	x	0.63	x	0.8	=	58.63	(81)
Northwest 0.9x	0.77	x	2.37	x	67.96	x	0.63	x	0.8	=	56.25	(81)
Northwest 0.9x	0.77	x	2.04	x	67.96	x	0.63	x	0.8	=	48.42	(81)
Northwest 0.9x	0.77	x	3.81	x	67.96	x	0.63	x	0.8	=	90.43	(81)
Northwest 0.9x	0.77	x	2.04	x	91.35	x	0.63	x	0.8	=	65.09	(81)
Northwest 0.9x	0.77	x	2.47	x	91.35	x	0.63	x	0.8	=	78.8	(81)
Northwest 0.9x	0.77	x	2.37	x	91.35	x	0.63	x	0.8	=	75.61	(81)
Northwest 0.9x	0.77	x	2.04	x	91.35	x	0.63	x	0.8	=	65.09	(81)
Northwest 0.9x	0.77	x	3.81	x	91.35	x	0.63	x	0.8	=	121.56	(81)
Northwest 0.9x	0.77	x	2.04	x	97.38	x	0.63	x	0.8	=	69.39	(81)
Northwest 0.9x	0.77	x	2.47	x	97.38	x	0.63	x	0.8	=	84.01	(81)
Northwest 0.9x	0.77	x	2.37	x	97.38	x	0.63	x	0.8	=	80.61	(81)
Northwest 0.9x	0.77	x	2.04	x	97.38	x	0.63	x	0.8	=	69.39	(81)
Northwest 0.9x	0.77	x	3.81	x	97.38	x	0.63	x	0.8	=	129.59	(81)
Northwest 0.9x	0.77	x	2.04	x	91.1	x	0.63	x	0.8	=	64.91	(81)
Northwest 0.9x	0.77	x	2.47	x	91.1	x	0.63	x	0.8	=	78.59	(81)
Northwest 0.9x	0.77	x	2.37	x	91.1	x	0.63	x	0.8	=	75.41	(81)
Northwest 0.9x	0.77	x	2.04	x	91.1	x	0.63	x	0.8	=	64.91	(81)
Northwest 0.9x	0.77	x	3.81	x	91.1	x	0.63	x	0.8	=	121.23	(81)
Northwest 0.9x	0.77	x	2.04	x	72.63	x	0.63	x	0.8	=	51.75	(81)
Northwest 0.9x	0.77	x	2.47	x	72.63	x	0.63	x	0.8	=	62.66	(81)
Northwest 0.9x	0.77	x	2.37	x	72.63	x	0.63	x	0.8	=	60.12	(81)
Northwest 0.9x	0.77	x	2.04	x	72.63	x	0.63	x	0.8	=	51.75	(81)

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Northwest 0.9x	0.77	x	3.81	x	72.63	x	0.63	x	0.8	=	96.65	(81)
Northwest 0.9x	0.77	x	2.04	x	50.42	x	0.63	x	0.8	=	35.93	(81)
Northwest 0.9x	0.77	x	2.47	x	50.42	x	0.63	x	0.8	=	43.5	(81)
Northwest 0.9x	0.77	x	2.37	x	50.42	x	0.63	x	0.8	=	41.74	(81)
Northwest 0.9x	0.77	x	2.04	x	50.42	x	0.63	x	0.8	=	35.93	(81)
Northwest 0.9x	0.77	x	3.81	x	50.42	x	0.63	x	0.8	=	67.1	(81)
Northwest 0.9x	0.77	x	2.04	x	28.07	x	0.63	x	0.8	=	20	(81)
Northwest 0.9x	0.77	x	2.47	x	28.07	x	0.63	x	0.8	=	24.21	(81)
Northwest 0.9x	0.77	x	2.37	x	28.07	x	0.63	x	0.8	=	23.23	(81)
Northwest 0.9x	0.77	x	2.04	x	28.07	x	0.63	x	0.8	=	20	(81)
Northwest 0.9x	0.77	x	3.81	x	28.07	x	0.63	x	0.8	=	37.35	(81)
Northwest 0.9x	0.77	x	2.04	x	14.2	x	0.63	x	0.8	=	10.12	(81)
Northwest 0.9x	0.77	x	2.47	x	14.2	x	0.63	x	0.8	=	12.25	(81)
Northwest 0.9x	0.77	x	2.37	x	14.2	x	0.63	x	0.8	=	11.75	(81)
Northwest 0.9x	0.77	x	2.04	x	14.2	x	0.63	x	0.8	=	10.12	(81)
Northwest 0.9x	0.77	x	3.81	x	14.2	x	0.63	x	0.8	=	18.89	(81)
Northwest 0.9x	0.77	x	2.04	x	9.21	x	0.63	x	0.8	=	6.57	(81)
Northwest 0.9x	0.77	x	2.47	x	9.21	x	0.63	x	0.8	=	7.95	(81)
Northwest 0.9x	0.77	x	2.37	x	9.21	x	0.63	x	0.8	=	7.63	(81)
Northwest 0.9x	0.77	x	2.04	x	9.21	x	0.63	x	0.8	=	6.57	(81)
Northwest 0.9x	0.77	x	3.81	x	9.21	x	0.63	x	0.8	=	12.26	(81)
Rooflights 0.9x	1	x	1.1	x	26	x	0.63	x	0.8	=	12.97	(82)
Rooflights 0.9x	1	x	0.76	x	26	x	0.63	x	0.8	=	9.02	(82)
Rooflights 0.9x	1	x	1.1	x	54	x	0.63	x	0.8	=	26.94	(82)
Rooflights 0.9x	1	x	0.76	x	54	x	0.63	x	0.8	=	18.74	(82)
Rooflights 0.9x	1	x	1.1	x	96	x	0.63	x	0.8	=	47.9	(82)
Rooflights 0.9x	1	x	0.76	x	96	x	0.63	x	0.8	=	33.31	(82)
Rooflights 0.9x	1	x	1.1	x	150	x	0.63	x	0.8	=	74.84	(82)
Rooflights 0.9x	1	x	0.76	x	150	x	0.63	x	0.8	=	52.05	(82)
Rooflights 0.9x	1	x	1.1	x	192	x	0.63	x	0.8	=	95.8	(82)
Rooflights 0.9x	1	x	0.76	x	192	x	0.63	x	0.8	=	66.62	(82)
Rooflights 0.9x	1	x	1.1	x	200	x	0.63	x	0.8	=	99.79	(82)
Rooflights 0.9x	1	x	0.76	x	200	x	0.63	x	0.8	=	69.4	(82)
Rooflights 0.9x	1	x	1.1	x	189	x	0.63	x	0.8	=	94.3	(82)
Rooflights 0.9x	1	x	0.76	x	189	x	0.63	x	0.8	=	65.58	(82)
Rooflights 0.9x	1	x	1.1	x	157	x	0.63	x	0.8	=	78.34	(82)
Rooflights 0.9x	1	x	0.76	x	157	x	0.63	x	0.8	=	54.48	(82)
Rooflights 0.9x	1	x	1.1	x	115	x	0.63	x	0.8	=	57.38	(82)
Rooflights 0.9x	1	x	0.76	x	115	x	0.63	x	0.8	=	39.91	(82)
Rooflights 0.9x	1	x	1.1	x	66	x	0.63	x	0.8	=	32.93	(82)
Rooflights 0.9x	1	x	0.76	x	66	x	0.63	x	0.8	=	22.9	(82)

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Rooflights 0.9x	1	x	1.1	x	33	x	0.63	x	0.8	=	16.47	(82)
Rooflights 0.9x	1	x	0.76	x	33	x	0.63	x	0.8	=	11.45	(82)
Rooflights 0.9x	1	x	1.1	x	21	x	0.63	x	0.8	=	10.48	(82)
Rooflights 0.9x	1	x	0.76	x	21	x	0.63	x	0.8	=	7.29	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	72.16	147.8	265.19	429.04	568.57	602.19	564.94	455.73	321.47	180.63	91.04	58.73	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	582.57	654.67	754.86	892.03	1004.4	1013.43	961.63	859.37	740.27	626.3	566.64	556.84	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.89	0.75	0.57	0.43	0.49	0.75	0.93	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.48	19.66	20.01	20.46	20.79	20.95	20.99	20.98	20.85	20.4	19.87	19.45	(87)

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

(88)m=	19.6	19.6	19.61	19.62	19.62	19.63	19.63	19.63	19.63	19.62	19.62	19.61	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.97	0.94	0.85	0.68	0.46	0.3	0.36	0.65	0.9	0.97	0.99	(89)

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

(90)m=	17.66	17.92	18.41	19.04	19.44	19.6	19.63	19.63	19.52	18.98	18.23	17.62	(90)

fLA = Living area ÷ (4) = 0.31 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.22	18.46	18.91	19.47	19.86	20.02	20.05	20.04	19.93	19.42	18.73	18.18	(92)

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

(93)m=	18.22	18.46	18.91	19.47	19.86	20.02	20.05	20.04	19.93	19.42	18.73	18.18	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.93	0.85	0.69	0.49	0.34	0.4	0.67	0.9	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	569.98	632.49	704.51	755.4	693.52	499.6	326.59	342.03	498.91	562.33	546.7	546.52	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1367.59	1329.16	1213.22	1023.31	787.91	518.36	329.81	347.96	559.86	851.64	1127.99	1361.72	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	593.43	468.16	378.48	192.9	70.22	0	0	0	0	215.25	418.52	606.51	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2943.46 (98)

Space heating requirement in kWh/m²/year 48.48 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	593.43	468.16	378.48	192.9	70.22	0	0	0	0	215.25	418.52	606.51	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	655.72	517.3	418.21	213.14	77.59	0	0	0	0	237.84	462.46	670.17	(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3252.44 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

Water heating

Output from water heater (calculated above)	188.24	166.21	175.24	158.04	155.57	140	135.4	147.27	146.6	163.84	172.04	184.03	
Efficiency of water heater													79.8 (216)
(217)m=	87.67	87.43	86.82	85.35	82.85	79.8	79.8	79.8	79.8	85.54	87.1	87.76	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	214.72	190.11	201.85	185.18	187.78	175.44	169.67	184.55	183.72	191.53	197.53	209.7	
Total = Sum(219a)$_{1...12}$ =													2291.76 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3252.44	
Water heating fuel used		2291.76	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		275.11	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5894.31	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	113.19	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)

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Water heating cost (other fuel)	(219)	3.48	x 0.01 =	79.75	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	36.29	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)…(254) =	359.12	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.43	(257)
SAP rating (Section 12)		80.1	(258)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	702.53	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	495.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1197.55	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	142.78	(268)
Total CO2, kg/year		sum of (265)…(271) =		1379.25	(272)
CO2 emissions per m²		(272) ÷ (4) =		22.72	(273)
EI rating (section 14)				83	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3967.98	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2795.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =			6763.93	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	844.58	(268)
'Total Primary Energy		sum of (265)…(271) =		7838.76	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		129.12	(273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Michael Langley	**Stroma Number:**	STRO036755
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: Flat 16 (Baseline)

Address : Flat 16, 11-12 Market Place, READING, RG1 2EG

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	60.71	(1a) x	3.5	(2a) =	212.48	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	60.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		212.48	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	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 and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.09	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.34	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(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 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

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

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 2			2.47	x1/[1/(1.4)+ 0.04]		=	3.27			(27)
Windows Type 3			2.37	x1/[1/(1.4)+ 0.04]		=	3.14			(27)
Windows Type 4			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 5			3.81	x1/[1/(1.4)+ 0.04]		=	5.05			(27)
Rooflights Type 1			1.1	x1/[1/(1.7) + 0.04]		=	1.87			(27b)
Rooflights Type 2			0.765	x1/[1/(1.7) + 0.04]		=	1.3005			(27b)
Walls	76.51	12.73	63.78	x	0.18	=	11.48			(29)
Roof	60.71	1.87	58.84	x	0.13	=	7.65			(30)
Total area of elements, m²			137.22							(31)
Party wall			55.51	x	0	=	0			(32)
Party floor			60.71							(32a)
Internal wall **			168.16							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6155.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 18.97 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 57.94 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.83	40.61	40.39	39.36	39.17	38.27	38.27	38.1	38.61	39.17	39.56	39.96	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	98.78	98.56	98.34	97.3	97.11	96.21	96.21	96.04	96.56	97.11	97.5	97.91

Average = Sum(39)$_{1...12}$ /12= 97.3 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.63	1.62	1.62	1.6	1.6	1.58	1.58	1.58	1.59	1.6	1.61	1.61

Average = Sum(40)$_{1...12}$ /12= 1.6 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 81.74 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	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)

(44)m=	89.91	86.64	83.37	80.1	76.83	73.56	73.56	76.83	80.1	83.37	86.64	89.91

Total = Sum(44)$_{1...12}$ = 980.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	133.34	116.62	120.34	104.91	100.67	86.87	80.5	92.37	93.47	108.94	118.91	129.13

Total = Sum(45)$_{1...12}$ = 1286.07 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20	17.49	18.05	15.74	15.1	13.03	12.07	13.86	14.02	16.34	17.84	19.37	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.89 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.02 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 1.02 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	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 calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.24	166.21	175.25	158.05	155.58	140	135.4	147.28	146.61	163.84	172.05	184.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.24	166.21	175.25	158.05	155.58	140	135.4	147.28	146.61	163.84	172.05	184.04

Output from water heater (annual)$_{1...12}$ | 1932.55 | (64)

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

(65)m=	88.26	78.45	83.94	77.39	77.4	71.39	70.69	74.64	73.59	80.15	82.05	86.86	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	100.08	(66)

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

(67)m=	15.58	13.84	11.25	8.52	6.37	5.38	5.81	7.55	10.13	12.87	15.02	16.01	(67)

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

(68)m=	174.73	176.55	171.98	162.25	149.97	138.43	130.72	128.91	133.48	143.2	155.48	167.02	(68)

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

(69)m=	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	33.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	-80.07	(71)

Water heating gains (Table 5)

(72)m=	118.63	116.74	112.82	107.49	104.03	99.16	95.01	100.32	102.21	107.72	113.95	116.75	(72)

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

(73)m=	364.97	363.15	352.08	334.28	316.39	298.99	287.57	292.8	301.84	319.82	340.48	355.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	2.04	x	11.28	x	0.63	x	0.7	=	7.03	(81)
Northwest 0.9x	0.77	x	2.47	x	11.28	x	0.63	x	0.7	=	8.52	(81)
Northwest 0.9x	0.77	x	2.37	x	11.28	x	0.63	x	0.7	=	8.17	(81)
Northwest 0.9x	0.77	x	2.04	x	11.28	x	0.63	x	0.7	=	7.03	(81)
Northwest 0.9x	0.77	x	3.81	x	11.28	x	0.63	x	0.7	=	13.14	(81)
Northwest 0.9x	0.77	x	2.04	x	22.97	x	0.63	x	0.7	=	14.32	(81)
Northwest 0.9x	0.77	x	2.47	x	22.97	x	0.63	x	0.7	=	17.34	(81)
Northwest 0.9x	0.77	x	2.37	x	22.97	x	0.63	x	0.7	=	16.63	(81)
Northwest 0.9x	0.77	x	2.04	x	22.97	x	0.63	x	0.7	=	14.32	(81)
Northwest 0.9x	0.77	x	3.81	x	22.97	x	0.63	x	0.7	=	26.74	(81)
Northwest 0.9x	0.77	x	2.04	x	41.38	x	0.63	x	0.7	=	25.8	(81)
Northwest 0.9x	0.77	x	2.47	x	41.38	x	0.63	x	0.7	=	31.24	(81)
Northwest 0.9x	0.77	x	2.37	x	41.38	x	0.63	x	0.7	=	29.97	(81)
Northwest 0.9x	0.77	x	2.04	x	41.38	x	0.63	x	0.7	=	25.8	(81)
Northwest 0.9x	0.77	x	3.81	x	41.38	x	0.63	x	0.7	=	48.18	(81)
Northwest 0.9x	0.77	x	2.04	x	67.96	x	0.63	x	0.7	=	42.37	(81)
Northwest 0.9x	0.77	x	2.47	x	67.96	x	0.63	x	0.7	=	51.3	(81)
Northwest 0.9x	0.77	x	2.37	x	67.96	x	0.63	x	0.7	=	49.22	(81)
Northwest 0.9x	0.77	x	2.04	x	67.96	x	0.63	x	0.7	=	42.37	(81)
Northwest 0.9x	0.77	x	3.81	x	67.96	x	0.63	x	0.7	=	79.13	(81)
Northwest 0.9x	0.77	x	2.04	x	91.35	x	0.63	x	0.7	=	56.95	(81)
Northwest 0.9x	0.77	x	2.47	x	91.35	x	0.63	x	0.7	=	68.95	(81)
Northwest 0.9x	0.77	x	2.37	x	91.35	x	0.63	x	0.7	=	66.16	(81)
Northwest 0.9x	0.77	x	2.04	x	91.35	x	0.63	x	0.7	=	56.95	(81)
Northwest 0.9x	0.77	x	3.81	x	91.35	x	0.63	x	0.7	=	106.36	(81)
Northwest 0.9x	0.77	x	2.04	x	97.38	x	0.63	x	0.7	=	60.71	(81)
Northwest 0.9x	0.77	x	2.47	x	97.38	x	0.63	x	0.7	=	73.51	(81)
Northwest 0.9x	0.77	x	2.37	x	97.38	x	0.63	x	0.7	=	70.54	(81)
Northwest 0.9x	0.77	x	2.04	x	97.38	x	0.63	x	0.7	=	60.71	(81)
Northwest 0.9x	0.77	x	3.81	x	97.38	x	0.63	x	0.7	=	113.39	(81)
Northwest 0.9x	0.77	x	2.04	x	91.1	x	0.63	x	0.7	=	56.8	(81)
Northwest 0.9x	0.77	x	2.47	x	91.1	x	0.63	x	0.7	=	68.77	(81)
Northwest 0.9x	0.77	x	2.37	x	91.1	x	0.63	x	0.7	=	65.98	(81)
Northwest 0.9x	0.77	x	2.04	x	91.1	x	0.63	x	0.7	=	56.8	(81)
Northwest 0.9x	0.77	x	3.81	x	91.1	x	0.63	x	0.7	=	106.08	(81)
Northwest 0.9x	0.77	x	2.04	x	72.63	x	0.63	x	0.7	=	45.28	(81)
Northwest 0.9x	0.77	x	2.47	x	72.63	x	0.63	x	0.7	=	54.82	(81)
Northwest 0.9x	0.77	x	2.37	x	72.63	x	0.63	x	0.7	=	52.6	(81)
Northwest 0.9x	0.77	x	2.04	x	72.63	x	0.63	x	0.7	=	45.28	(81)

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Northwest 0.9x	0.77	x	3.81	x	72.63	x	0.63	x	0.7	=	84.57	(81)
Northwest 0.9x	0.77	x	2.04	x	50.42	x	0.63	x	0.7	=	31.43	(81)
Northwest 0.9x	0.77	x	2.47	x	50.42	x	0.63	x	0.7	=	38.06	(81)
Northwest 0.9x	0.77	x	2.37	x	50.42	x	0.63	x	0.7	=	36.52	(81)
Northwest 0.9x	0.77	x	2.04	x	50.42	x	0.63	x	0.7	=	31.43	(81)
Northwest 0.9x	0.77	x	3.81	x	50.42	x	0.63	x	0.7	=	58.71	(81)
Northwest 0.9x	0.77	x	2.04	x	28.07	x	0.63	x	0.7	=	17.5	(81)
Northwest 0.9x	0.77	x	2.47	x	28.07	x	0.63	x	0.7	=	21.19	(81)
Northwest 0.9x	0.77	x	2.37	x	28.07	x	0.63	x	0.7	=	20.33	(81)
Northwest 0.9x	0.77	x	2.04	x	28.07	x	0.63	x	0.7	=	17.5	(81)
Northwest 0.9x	0.77	x	3.81	x	28.07	x	0.63	x	0.7	=	32.68	(81)
Northwest 0.9x	0.77	x	2.04	x	14.2	x	0.63	x	0.7	=	8.85	(81)
Northwest 0.9x	0.77	x	2.47	x	14.2	x	0.63	x	0.7	=	10.72	(81)
Northwest 0.9x	0.77	x	2.37	x	14.2	x	0.63	x	0.7	=	10.28	(81)
Northwest 0.9x	0.77	x	2.04	x	14.2	x	0.63	x	0.7	=	8.85	(81)
Northwest 0.9x	0.77	x	3.81	x	14.2	x	0.63	x	0.7	=	16.53	(81)
Northwest 0.9x	0.77	x	2.04	x	9.21	x	0.63	x	0.7	=	5.74	(81)
Northwest 0.9x	0.77	x	2.47	x	9.21	x	0.63	x	0.7	=	6.96	(81)
Northwest 0.9x	0.77	x	2.37	x	9.21	x	0.63	x	0.7	=	6.67	(81)
Northwest 0.9x	0.77	x	2.04	x	9.21	x	0.63	x	0.7	=	5.74	(81)
Northwest 0.9x	0.77	x	3.81	x	9.21	x	0.63	x	0.7	=	10.73	(81)
Rooflights 0.9x	1	x	1.1	x	26	x	0.63	x	0.7	=	11.35	(82)
Rooflights 0.9x	1	x	0.76	x	26	x	0.63	x	0.7	=	7.89	(82)
Rooflights 0.9x	1	x	1.1	x	54	x	0.63	x	0.7	=	23.58	(82)
Rooflights 0.9x	1	x	0.76	x	54	x	0.63	x	0.7	=	16.4	(82)
Rooflights 0.9x	1	x	1.1	x	96	x	0.63	x	0.7	=	41.91	(82)
Rooflights 0.9x	1	x	0.76	x	96	x	0.63	x	0.7	=	29.15	(82)
Rooflights 0.9x	1	x	1.1	x	150	x	0.63	x	0.7	=	65.49	(82)
Rooflights 0.9x	1	x	0.76	x	150	x	0.63	x	0.7	=	45.54	(82)
Rooflights 0.9x	1	x	1.1	x	192	x	0.63	x	0.7	=	83.83	(82)
Rooflights 0.9x	1	x	0.76	x	192	x	0.63	x	0.7	=	58.3	(82)
Rooflights 0.9x	1	x	1.1	x	200	x	0.63	x	0.7	=	87.32	(82)
Rooflights 0.9x	1	x	0.76	x	200	x	0.63	x	0.7	=	60.73	(82)
Rooflights 0.9x	1	x	1.1	x	189	x	0.63	x	0.7	=	82.52	(82)
Rooflights 0.9x	1	x	0.76	x	189	x	0.63	x	0.7	=	57.39	(82)
Rooflights 0.9x	1	x	1.1	x	157	x	0.63	x	0.7	=	68.54	(82)
Rooflights 0.9x	1	x	0.76	x	157	x	0.63	x	0.7	=	47.67	(82)
Rooflights 0.9x	1	x	1.1	x	115	x	0.63	x	0.7	=	50.21	(82)
Rooflights 0.9x	1	x	0.76	x	115	x	0.63	x	0.7	=	34.92	(82)
Rooflights 0.9x	1	x	1.1	x	66	x	0.63	x	0.7	=	28.81	(82)
Rooflights 0.9x	1	x	0.76	x	66	x	0.63	x	0.7	=	20.04	(82)

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Rooflights 0.9x	1	x	1.1	x	33	x	0.63	x	0.7	=	14.41	(82)
Rooflights 0.9x	1	x	0.76	x	33	x	0.63	x	0.7	=	10.02	(82)
Rooflights 0.9x	1	x	1.1	x	21	x	0.63	x	0.7	=	9.17	(82)
Rooflights 0.9x	1	x	0.76	x	21	x	0.63	x	0.7	=	6.38	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	63.14	129.32	232.04	375.41	497.5	526.91	494.33	398.77	281.28	158.05	79.66	51.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	428.11	492.47	584.12	709.7	813.89	825.9	781.9	691.57	583.13	477.87	420.14	407.2	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.83	0.67	0.52	0.59	0.85	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.26	19.44	19.78	20.27	20.68	20.91	20.97	20.96	20.75	20.22	19.66	19.23	(87)

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

(88)m=	19.59	19.6	19.6	19.61	19.61	19.62	19.62	19.63	19.62	19.61	19.61	19.6	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.92	0.77	0.55	0.37	0.44	0.76	0.95	0.99	1	(89)

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

(90)m=	17.33	17.59	18.1	18.79	19.32	19.57	19.62	19.61	19.43	18.74	17.93	17.3	(90)

fLA = Living area ÷ (4) = | 0.31 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.93	18.16	18.62	19.25	19.74	19.98	20.04	20.03	19.84	19.19	18.46	17.9	(92)

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

(93)m=	17.93	18.16	18.62	19.25	19.74	19.98	20.04	20.03	19.84	19.19	18.46	17.9	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.78	0.59	0.41	0.49	0.78	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	424.53	485.26	564.48	644.05	633.89	483.39	323.91	336.15	452.25	452.95	414.04	404.38	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1346.03	1306.94	1191.65	1006.77	780.79	517.81	330.53	348.26	554.11	834.54	1107.81	1340.97	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	685.6	552.17	466.61	261.16	109.29	0	0	0	0	283.9	499.51	696.82	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 3555.07 | (98)

Space heating requirement in kWh/m²/year | 58.56 | (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	685.6	552.17	466.61	261.16	109.29	0	0	0	0	283.9	499.51	696.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	733.26	590.56	499.05	279.31	116.89	0	0	0	0	303.64	534.24	745.27	(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3802.21 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

Water heating

Output from water heater (calculated above)	188.24	166.21	175.25	158.05	155.58	140	135.4	147.28	146.61	163.84	172.05	184.04	
Efficiency of water heater													79.8 (216)
(217)m=	87.96	87.78	87.3	86.15	83.89	79.8	79.8	79.8	79.8	86.27	87.49	88.03	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	214.01	189.36	200.73	183.47	185.45	175.44	169.68	184.56	183.72	189.92	196.64	209.05	
Total = Sum(219a)$_{1...12}$ =													2282.04 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3802.21	
Water heating fuel used		2282.04	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		275.11	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6434.36	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	821.28	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	492.92	(264)

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Space and water heating	(261) + (262) + (263) + (264) =			1314.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	142.78	(268)
Total CO2, kg/year		sum of (265)…(271) =		1495.9	(272)

TER = 24.64 (273)

Thermal Bridge Report

Property Details: Flat 16 (Baseline)

Address:	Flat 16, 11-12 Market Place, READING, RG1 2EG
Located in:	England
Region:	Thames valley

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.1382

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	0.05	5.92	E2	[UD]
Sill	0.05	5.92	E3	[UD]
Jamb	0.05	21.5	E4	[UD]
Party floor between dwellings (in blocks of flats)	0.07	21.86	E7	[UD]
Flat roof with parapet	0.56	21.86	E15	[UD]
Corner (normal)	0.09	7	E16	[UD]
Party wall between dwellings	0.06	7	E18	[UD]

Party Junctions Details:

Intermediate floor between dwellings (in blocks of flats)	0	15.86	P3	[UD]
Roof (insulation at ceiling level)	0.12	15.86	P4	[UD]

Roof Junctions Details:

Head	0.08	1.95	R1	[UD]
Sill	0.06	1.95	R2	[UD]
Jamb	0.08	3.8	R3	[UD]