DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block A - Ground Floor

Address : A, Block A, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	90.84	(1a)	x	2.5	(2a)	=	227.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.84	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			227.1	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 2			9.24	x1/[1/(1.2)+ 0.04]		=	10.58			(27)
Windows Type 3			2.23	x1/[1/(1.2)+ 0.04]		=	2.55			(27)
Windows Type 4			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 5			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 6			5.64	x1/[1/(1.2)+ 0.04]		=	6.46			(27)
Windows Type 7			3.96	x1/[1/(1.2)+ 0.04]		=	4.53			(27)
Windows Type 8			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Floor			90.84	x	0.1	=	9.084			(28)
Walls Type1	73.47	31.6	41.87	x	0.16	=	6.7			(29)
Walls Type2	35.83	1.91	33.92	x	0.15	=	5.1			(29)
Total area of elements, m²			200.14							(31)
Party ceiling			90.84							(32b)

** 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) = 58.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13399.71 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		14.63	(36)
if details of thermal bridging are not known (36) = 0.05 x (31)			
Total fabric heat loss	(33) + (36) =	73.61	(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=	22.18	21.92	21.66	20.35	20.08	18.77	18.77	18.51	19.3	20.08	20.61	21.13	(38)

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

(39)m=	95.79	95.53	95.27	93.96	93.69	92.38	92.38	92.12	92.91	93.69	94.22	94.74	

Average = $Sum(39)_{1...12}$ /12= 93.89 (39)

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

(40)m=	1.05	1.05	1.05	1.03	1.03	1.02	1.02	1.01	1.02	1.03	1.04	1.04	

Average = $Sum(40)_{1...12}$ /12= 1.03 (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	2.64	(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	96.83	(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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	106.51	102.64	98.77	94.89	91.02	87.15	87.15	91.02	94.89	98.77	102.64	106.51	

Total = $Sum(44)_{1...12}$ = 1161.96 (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=	157.96	138.15	142.56	124.28	119.25	102.91	95.36	109.43	110.73	129.05	140.87	152.97	

Total = $Sum(45)_{1...12}$ = 1523.51 (45)

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

(46)m=	23.69	20.72	21.38	18.64	17.89	15.44	14.3	16.41	16.61	19.36	21.13	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		0	(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) =	110	(50)
b) If manufacturer’s declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02	(51)
If community heating see section 4.3			
Volume factor from Table 2a		1.03	(52)
Temperature factor from Table 2b		0.6	(53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	213.23	188.08	197.83	177.78	174.53	156.4	150.64	164.7	164.23	184.32	194.36	208.25	(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=	213.23	188.08	197.83	177.78	174.53	156.4	150.64	164.7	164.23	184.32	194.36	208.25	

Output from water heater (annual)$_{1...12}$ 2174.35 (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=	96.74	85.88	91.62	84.12	83.87	77.01	75.93	80.61	79.61	87.13	89.63	95.08	(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=	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85	131.85	(66)

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

(67)m=	21.45	19.05	15.49	11.73	8.77	7.4	8	10.4	13.96	17.72	20.68	22.05	(67)

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

(68)m=	240.61	243.11	236.82	223.42	206.52	190.62	180.01	177.51	183.8	197.2	214.11	230	(68)

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

(69)m=	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	(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=	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	-105.48	(71)

Water heating gains (Table 5)

(72)m=	130.03	127.79	123.15	116.83	112.73	106.96	102.05	108.34	110.57	117.11	124.49	127.8	(72)

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

(73)m=	454.65	452.51	438.02	414.54	390.57	367.54	352.62	358.81	370.89	394.58	421.83	442.4	(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)	
Northeast	0.9x	0.77	x	2.23	x	11.28	x	0.45	x	0.7	=	5.49	(75)
Northeast	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(75)
Northeast	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(75)
Northeast	0.9x	0.77	x	5.64	x	11.28	x	0.45	x	0.7	=	13.89	(75)
Northeast	0.9x	0.77	x	2.23	x	22.97	x	0.45	x	0.7	=	11.18	(75)
Northeast	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(75)
Northeast	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(75)
Northeast	0.9x	0.77	x	5.64	x	22.97	x	0.45	x	0.7	=	28.28	(75)
Northeast	0.9x	0.77	x	2.23	x	41.38	x	0.45	x	0.7	=	20.14	(75)
Northeast	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(75)
Northeast	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(75)
Northeast	0.9x	0.77	x	5.64	x	41.38	x	0.45	x	0.7	=	50.94	(75)
Northeast	0.9x	0.77	x	2.23	x	67.96	x	0.45	x	0.7	=	33.08	(75)
Northeast	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(75)
Northeast	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(75)
Northeast	0.9x	0.77	x	5.64	x	67.96	x	0.45	x	0.7	=	83.67	(75)
Northeast	0.9x	0.77	x	2.23	x	91.35	x	0.45	x	0.7	=	44.47	(75)
Northeast	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(75)
Northeast	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(75)
Northeast	0.9x	0.77	x	5.64	x	91.35	x	0.45	x	0.7	=	112.46	(75)
Northeast	0.9x	0.77	x	2.23	x	97.38	x	0.45	x	0.7	=	47.41	(75)
Northeast	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(75)
Northeast	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(75)
Northeast	0.9x	0.77	x	5.64	x	97.38	x	0.45	x	0.7	=	119.9	(75)
Northeast	0.9x	0.77	x	2.23	x	91.1	x	0.45	x	0.7	=	44.35	(75)
Northeast	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(75)
Northeast	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(75)
Northeast	0.9x	0.77	x	5.64	x	91.1	x	0.45	x	0.7	=	112.16	(75)
Northeast	0.9x	0.77	x	2.23	x	72.63	x	0.45	x	0.7	=	35.35	(75)
Northeast	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(75)
Northeast	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(75)
Northeast	0.9x	0.77	x	5.64	x	72.63	x	0.45	x	0.7	=	89.42	(75)
Northeast	0.9x	0.77	x	2.23	x	50.42	x	0.45	x	0.7	=	24.54	(75)
Northeast	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(75)
Northeast	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(75)
Northeast	0.9x	0.77	x	5.64	x	50.42	x	0.45	x	0.7	=	62.08	(75)
Northeast	0.9x	0.77	x	2.23	x	28.07	x	0.45	x	0.7	=	13.66	(75)
Northeast	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(75)
Northeast	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(75)

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Northeast	0.9x	0.77	x	5.64	x	28.07	x	0.45	x	0.7	=	34.56	(75)
Northeast	0.9x	0.77	x	2.23	x	14.2	x	0.45	x	0.7	=	6.91	(75)
Northeast	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(75)
Northeast	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(75)
Northeast	0.9x	0.77	x	5.64	x	14.2	x	0.45	x	0.7	=	17.48	(75)
Northeast	0.9x	0.77	x	2.23	x	9.21	x	0.45	x	0.7	=	4.49	(75)
Northeast	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(75)
Northeast	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(75)
Northeast	0.9x	0.77	x	5.64	x	9.21	x	0.45	x	0.7	=	11.34	(75)
Southeast	0.9x	0.77	x	3.96	x	36.79	x	0.45	x	0.7	=	31.81	(77)
Southeast	0.9x	0.77	x	3.24	x	36.79	x	0.45	x	0.7	=	26.02	(77)
Southeast	0.9x	0.77	x	3.96	x	62.67	x	0.45	x	0.7	=	54.18	(77)
Southeast	0.9x	0.77	x	3.24	x	62.67	x	0.45	x	0.7	=	44.33	(77)
Southeast	0.9x	0.77	x	3.96	x	85.75	x	0.45	x	0.7	=	74.13	(77)
Southeast	0.9x	0.77	x	3.24	x	85.75	x	0.45	x	0.7	=	60.65	(77)
Southeast	0.9x	0.77	x	3.96	x	106.25	x	0.45	x	0.7	=	91.85	(77)
Southeast	0.9x	0.77	x	3.24	x	106.25	x	0.45	x	0.7	=	75.15	(77)
Southeast	0.9x	0.77	x	3.96	x	119.01	x	0.45	x	0.7	=	102.88	(77)
Southeast	0.9x	0.77	x	3.24	x	119.01	x	0.45	x	0.7	=	84.17	(77)
Southeast	0.9x	0.77	x	3.96	x	118.15	x	0.45	x	0.7	=	102.13	(77)
Southeast	0.9x	0.77	x	3.24	x	118.15	x	0.45	x	0.7	=	83.56	(77)
Southeast	0.9x	0.77	x	3.96	x	113.91	x	0.45	x	0.7	=	98.47	(77)
Southeast	0.9x	0.77	x	3.24	x	113.91	x	0.45	x	0.7	=	80.57	(77)
Southeast	0.9x	0.77	x	3.96	x	104.39	x	0.45	x	0.7	=	90.24	(77)
Southeast	0.9x	0.77	x	3.24	x	104.39	x	0.45	x	0.7	=	73.83	(77)
Southeast	0.9x	0.77	x	3.96	x	92.85	x	0.45	x	0.7	=	80.27	(77)
Southeast	0.9x	0.77	x	3.24	x	92.85	x	0.45	x	0.7	=	65.67	(77)
Southeast	0.9x	0.77	x	3.96	x	69.27	x	0.45	x	0.7	=	59.88	(77)
Southeast	0.9x	0.77	x	3.24	x	69.27	x	0.45	x	0.7	=	48.99	(77)
Southeast	0.9x	0.77	x	3.96	x	44.07	x	0.45	x	0.7	=	38.1	(77)
Southeast	0.9x	0.77	x	3.24	x	44.07	x	0.45	x	0.7	=	31.17	(77)
Southeast	0.9x	0.77	x	3.96	x	31.49	x	0.45	x	0.7	=	27.22	(77)
Southeast	0.9x	0.77	x	3.24	x	31.49	x	0.45	x	0.7	=	22.27	(77)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	9.24	x	11.28	x	0.45	x	0.7	=	22.76	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	9.24	x	22.97	x	0.45	x	0.7	=	46.32	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	9.24	x	41.38	x	0.45	x	0.7	=	83.46	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	9.24	x	67.96	x	0.45	x	0.7	=	137.07	(81)

Northwest 0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest 0.9x	0.77	x	9.24	x	91.35	x	0.45	x	0.7	=	184.25	(81)
Northwest 0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest 0.9x	0.77	x	9.24	x	97.38	x	0.45	x	0.7	=	196.43	(81)
Northwest 0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest 0.9x	0.77	x	9.24	x	91.1	x	0.45	x	0.7	=	183.76	(81)
Northwest 0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest 0.9x	0.77	x	9.24	x	72.63	x	0.45	x	0.7	=	146.49	(81)
Northwest 0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest 0.9x	0.77	x	9.24	x	50.42	x	0.45	x	0.7	=	101.7	(81)
Northwest 0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest 0.9x	0.77	x	9.24	x	28.07	x	0.45	x	0.7	=	56.61	(81)
Northwest 0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest 0.9x	0.77	x	9.24	x	14.2	x	0.45	x	0.7	=	28.64	(81)
Northwest 0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)
Northwest 0.9x	0.77	x	9.24	x	9.21	x	0.45	x	0.7	=	18.59	(81)

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

(83)m=	117.93	220.84	355.18	528.96	673.6	704.41	664.27	550.91	414.5	258.37	144.88	98.57	(83)

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

(84)m=	572.58	673.35	793.2	943.5	1064.17	1071.95	1016.89	909.72	785.39	652.95	566.72	540.97	(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=	0.96	0.94	0.9	0.8	0.66	0.5	0.38	0.44	0.66	0.86	0.94	0.97	(86)

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

(87)m=	18.87	19.16	19.63	20.22	20.65	20.89	20.96	20.94	20.75	20.16	19.41	18.82	(87)

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

(88)m=	20.04	20.04	20.04	20.05	20.06	20.07	20.07	20.07	20.06	20.06	20.05	20.05	(88)

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

(89)m=	0.96	0.93	0.88	0.77	0.62	0.44	0.31	0.36	0.6	0.84	0.93	0.96	(89)

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

(90)m=	17.18	17.6	18.28	19.1	19.67	19.97	20.04	20.03	19.81	19.04	17.98	17.11	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	17.73	18.11	18.72	19.47	20	20.27	20.35	20.33	20.12	19.41	18.45	17.67	(92)

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

(93)m=	17.73	18.11	18.72	19.47	20	20.27	20.35	20.33	20.12	19.41	18.45	17.67	(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

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Utilisation factor for gains, hm:

(94)m=	0.94	0.91	0.86	0.75	0.61	0.45	0.33	0.38	0.6	0.82	0.91	0.94	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	536.76	612.16	678.81	712.06	652.29	485.82	334.97	345.58	473.91	532.6	516.79	511.04	(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=	1286.88	1262.12	1164.49	992.99	777.33	523.81	346.06	362.23	559.39	825.04	1069.58	1276.6	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	558.09	436.77	361.35	202.27	93.03	0	0	0	0	217.57	398.01	569.58

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2836.67 (98)

Space heating requirement in kWh/m²/year 31.23 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2836.67	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3404.01	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2174.35	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2609.22	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	60.13	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		205.58	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	205.58	(331)

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Energy for lighting (calculated in Appendix L)				378.83	(332)
Electricity generated by PVs (Appendix M) (negative quantity)				-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =				5867.56	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52 =	1114.59	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	31.21	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1145.8	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1145.8	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	106.7	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	196.61	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)...(382) =			1070.2	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			11.78	(384)
EI rating (section 14)				89.44	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block A - Mid Floor

Address : A, Block A, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.62	(1a) x	2.5	(2a) =	179.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.62	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.05	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x 1	= 1.91			(26)
Windows Type 1			2.43	x1/[1/(1.2)+ 0.04]	= 2.78			(27)
Windows Type 2			5.64	x1/[1/(1.2)+ 0.04]	= 6.46			(27)
Windows Type 3			3.84	x1/[1/(1.2)+ 0.04]	= 4.4			(27)
Windows Type 4			3.24	x1/[1/(1.2)+ 0.04]	= 3.71			(27)
Windows Type 5			2.43	x1/[1/(1.2)+ 0.04]	= 2.78			(27)
Windows Type 6			2.43	x1/[1/(1.2)+ 0.04]	= 2.78			(27)
Walls Type1	46.65	20.01	26.64	x 0.16	= 4.26			(29)
Walls Type2	9.05	1.91	7.14	x 0.15	= 1.07			(29)
Total area of elements, m²			55.7					(31)
Party wall			37.72	x 0	= 0			(32)
Party floor			71.62					(32a)
Party ceiling			71.62					(32b)

** 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) = 30.16 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7015.05 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 6.47 (36)

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

Total fabric heat loss (33) + (36) = 36.63 (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=	17.49	17.28	17.08	16.04	15.84	14.8	14.8	14.59	15.21	15.84	16.25	16.66	(38)

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

(39)m=	54.12	53.91	53.7	52.67	52.46	51.43	51.43	51.22	51.84	52.46	52.88	53.29	

Average = $Sum(39)_{1...12}$ /12= 52.62 (39)

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

(40)m=	0.76	0.75	0.75	0.74	0.73	0.72	0.72	0.72	0.72	0.73	0.74	0.74	

Average = $Sum(40)_{1...12}$ /12= 0.73 (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 2.28 (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 88.46 (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	
(44)m=	97.31	93.77	90.23	86.69	83.16	79.62	79.62	83.16	86.69	90.23	93.77	97.31	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = $Sum(44)_{1...12}$ = 1061.57 (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=	144.31	126.21	130.24	113.55	108.95	94.02	87.12	99.97	101.17	117.9	128.7	139.76	

Total = $Sum(45)_{1...12}$ = 1391.88 (45)

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

(46)m=	21.65	18.93	19.54	17.03	16.34	14.1	13.07	15	15.17	17.68	19.3	20.96	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	199.59	176.14	185.52	167.04	164.23	147.51	142.4	155.25	154.66	173.18	182.19	195.03	(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=	199.59	176.14	185.52	167.04	164.23	147.51	142.4	155.25	154.66	173.18	182.19	195.03	

Output from water heater (annual)$_{1...12}$ — 2042.72 (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=	92.2	81.91	87.53	80.55	80.45	74.06	73.19	77.46	76.43	83.42	85.59	90.69	(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=	114.24	114.24	114.24	114.24	114.24	114.24	114.24	114.24	114.24	114.24	114.24	114.24	(66)

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

(67)m=	17.92	15.92	12.95	9.8	7.33	6.19	6.68	8.69	11.66	14.81	17.28	18.42	(67)

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

(68)m=	201.05	203.13	197.88	186.68	172.56	159.28	150.41	148.32	153.58	164.77	178.9	192.18	(68)

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

(69)m=	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	(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=	-91.39	-91.39	-91.39	-91.39	-91.39	-91.39	-91.39	-91.39	-91.39	-91.39	-91.39	-91.39	(71)

Water heating gains (Table 5)

(72)m=	123.93	121.89	117.64	111.87	108.13	102.85	98.37	104.12	106.16	112.13	118.87	121.9	(72)

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

(73)m=	400.17	398.21	385.74	365.63	345.28	325.59	312.74	318.4	328.67	348.98	372.32	389.77	(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)	
Southeast	0.9x	0.77	x	3.84	x	36.79	x	0.45	x	0.7	=	30.84	(77)
Southeast	0.9x	0.77	x	3.24	x	36.79	x	0.45	x	0.7	=	26.02	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	3.84	x	62.67	x	0.45	x	0.7	=	52.54	(77)
Southeast	0.9x	0.77	x	3.24	x	62.67	x	0.45	x	0.7	=	44.33	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	3.84	x	85.75	x	0.45	x	0.7	=	71.88	(77)
Southeast	0.9x	0.77	x	3.24	x	85.75	x	0.45	x	0.7	=	60.65	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	3.84	x	106.25	x	0.45	x	0.7	=	89.07	(77)
Southeast	0.9x	0.77	x	3.24	x	106.25	x	0.45	x	0.7	=	75.15	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	3.84	x	119.01	x	0.45	x	0.7	=	99.76	(77)
Southeast	0.9x	0.77	x	3.24	x	119.01	x	0.45	x	0.7	=	84.17	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	3.84	x	118.15	x	0.45	x	0.7	=	99.04	(77)
Southeast	0.9x	0.77	x	3.24	x	118.15	x	0.45	x	0.7	=	83.56	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	3.84	x	113.91	x	0.45	x	0.7	=	95.48	(77)
Southeast	0.9x	0.77	x	3.24	x	113.91	x	0.45	x	0.7	=	80.57	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	3.84	x	104.39	x	0.45	x	0.7	=	87.51	(77)
Southeast	0.9x	0.77	x	3.24	x	104.39	x	0.45	x	0.7	=	73.83	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	3.84	x	92.85	x	0.45	x	0.7	=	77.83	(77)
Southeast	0.9x	0.77	x	3.24	x	92.85	x	0.45	x	0.7	=	65.67	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	3.84	x	69.27	x	0.45	x	0.7	=	58.06	(77)
Southeast	0.9x	0.77	x	3.24	x	69.27	x	0.45	x	0.7	=	48.99	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)

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Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	3.84	x	44.07	x	0.45	x	0.7	=	36.94	(77)
Southeast	0.9x	0.77	x	3.24	x	44.07	x	0.45	x	0.7	=	31.17	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	3.84	x	31.49	x	0.45	x	0.7	=	26.39	(77)
Southeast	0.9x	0.77	x	3.24	x	31.49	x	0.45	x	0.7	=	22.27	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southwest	0.9x	0.77	x	2.43	x	36.79		0.45	x	0.7	=	19.52	(79)
Southwest	0.9x	0.77	x	5.64	x	36.79		0.45	x	0.7	=	45.3	(79)
Southwest	0.9x	0.77	x	2.43	x	62.67		0.45	x	0.7	=	33.25	(79)
Southwest	0.9x	0.77	x	5.64	x	62.67		0.45	x	0.7	=	77.16	(79)
Southwest	0.9x	0.77	x	2.43	x	85.75		0.45	x	0.7	=	45.49	(79)
Southwest	0.9x	0.77	x	5.64	x	85.75		0.45	x	0.7	=	105.58	(79)
Southwest	0.9x	0.77	x	2.43	x	106.25		0.45	x	0.7	=	56.36	(79)
Southwest	0.9x	0.77	x	5.64	x	106.25		0.45	x	0.7	=	130.82	(79)
Southwest	0.9x	0.77	x	2.43	x	119.01		0.45	x	0.7	=	63.13	(79)
Southwest	0.9x	0.77	x	5.64	x	119.01		0.45	x	0.7	=	146.52	(79)
Southwest	0.9x	0.77	x	2.43	x	118.15		0.45	x	0.7	=	62.67	(79)
Southwest	0.9x	0.77	x	5.64	x	118.15		0.45	x	0.7	=	145.46	(79)
Southwest	0.9x	0.77	x	2.43	x	113.91		0.45	x	0.7	=	60.42	(79)
Southwest	0.9x	0.77	x	5.64	x	113.91		0.45	x	0.7	=	140.24	(79)
Southwest	0.9x	0.77	x	2.43	x	104.39		0.45	x	0.7	=	55.37	(79)
Southwest	0.9x	0.77	x	5.64	x	104.39		0.45	x	0.7	=	128.52	(79)
Southwest	0.9x	0.77	x	2.43	x	92.85		0.45	x	0.7	=	49.25	(79)
Southwest	0.9x	0.77	x	5.64	x	92.85		0.45	x	0.7	=	114.32	(79)
Southwest	0.9x	0.77	x	2.43	x	69.27		0.45	x	0.7	=	36.74	(79)
Southwest	0.9x	0.77	x	5.64	x	69.27		0.45	x	0.7	=	85.28	(79)
Southwest	0.9x	0.77	x	2.43	x	44.07		0.45	x	0.7	=	23.38	(79)
Southwest	0.9x	0.77	x	5.64	x	44.07		0.45	x	0.7	=	54.26	(79)
Southwest	0.9x	0.77	x	2.43	x	31.49		0.45	x	0.7	=	16.7	(79)
Southwest	0.9x	0.77	x	5.64	x	31.49		0.45	x	0.7	=	38.77	(79)

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

(83)m=	160.72	273.76	374.57	464.12	519.85	516.09	497.56	455.99	405.58	302.57	192.5	137.54	(83)

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

(84)m=	560.89	671.98	760.31	829.75	865.13	841.68	810.3	774.38	734.25	651.54	564.83	527.31	(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

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(86)m=	0.92	0.86	0.79	0.67	0.53	0.38	0.28	0.3	0.47	0.71	0.87	0.93	(86)

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

(87)m=	19.87	20.17	20.47	20.76	20.91	20.98	21	20.99	20.96	20.75	20.29	19.82	(87)

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

(88)m=	20.29	20.29	20.3	20.31	20.31	20.32	20.32	20.33	20.32	20.31	20.31	20.3	(88)

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

(89)m=	0.91	0.85	0.77	0.64	0.5	0.34	0.24	0.26	0.43	0.68	0.85	0.92	(89)

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

(90)m=	18.78	19.2	19.63	20.01	20.21	20.31	20.32	20.32	20.28	20.02	19.38	18.72	(90)

fLA = Living area ÷ (4) = 0.29 (91)

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

(92)m=	19.1	19.48	19.87	20.23	20.42	20.5	20.52	20.52	20.47	20.23	19.64	19.04	(92)

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

(93)m=	19.1	19.48	19.87	20.23	20.42	20.5	20.52	20.52	20.47	20.23	19.64	19.04	(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=	0.89	0.83	0.75	0.64	0.5	0.35	0.25	0.27	0.44	0.67	0.84	0.9	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	499.06	559.26	572.95	528.83	433.17	298.36	200.36	209.41	319.54	437.52	472.26	476.29	(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=	800.91	785.89	718.04	596.64	457.23	303.45	201.4	210.85	330.43	505.09	663.31	790.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	224.58	152.3	107.95	48.82	17.91	0	0	0	0	50.27	137.56	233.9	

Total per year (kWh/year) = $\text{Sum}(98)_{1...5,9...12}$ = 973.28 (98)

Space heating requirement in kWh/m²/year 13.59 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump	1	(303a)
Fraction of total space heat from Community heat pump (302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	1.2	(306)

Space heating **kWh/year**

Annual space heating requirement 973.28

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1167.94	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2042.72	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2451.27	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.19	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		162.08	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	162.08	(331)
Energy for lighting (calculated in Appendix L)		316.54	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3367.75	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	670.85	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.78	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	689.63	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				689.63	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	84.12	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	164.28	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				559.12	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				7.81	(384)
EI rating (section 14)					93.58	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block B - Ground Floor

Address : B, Block B, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.34	(1a) x	2.5	(2a) =	175.85	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.34	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		175.85	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 2			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 3			9.24	x1/[1/(1.2)+ 0.04]		=	10.58			(27)
Windows Type 4			3.72	x1/[1/(1.2)+ 0.04]		=	4.26			(27)
Windows Type 5			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Floor			70.34	x	0.1	=	7.034			(28)
Walls Type1	46.9	20.25	26.65	x	0.16	=	4.26			(29)
Walls Type2	28.62	1.91	26.72	x	0.15	=	4.02			(29)
Total area of elements, m²			145.86							(31)
Party wall			18.5	x	0	=	0			(32)
Party ceiling			70.34							(32b)

** 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) =	40.41	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	11160.38	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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	11.25	(36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss	(33) + (36) =	51.66	(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=	17.18	16.97	16.77	15.76	15.55	14.54	14.54	14.33	14.94	15.55	15.96	16.36	(38)

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

(39)m=	68.84	68.64	68.43	67.42	67.21	66.2	66.2	66	66.6	67.21	67.62	68.03	

Average = Sum(39)$_{1…12}$ /12= 67.37 (39)

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

(40)m=	0.98	0.98	0.97	0.96	0.96	0.94	0.94	0.94	0.95	0.96	0.96	0.97	

Average = Sum(40)$_{1…12}$ /12= 0.96 (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 2.25 (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 87.74 (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=	96.51	93.01	89.5	85.99	82.48	78.97	78.97	82.48	85.99	89.5	93.01	96.51	

Total = Sum(44)$_{1…12}$ = 1052.89 (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=	143.13	125.18	129.18	112.62	108.06	93.25	86.41	99.15	100.34	116.93	127.64	138.61	

Total = Sum(45)$_{1…12}$ = 1380.5 (45)

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

(46)m=	21.47	18.78	19.38	16.89	16.21	13.99	12.96	14.87	15.05	17.54	19.15	20.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	198.41	175.11	184.45	166.11	163.34	146.74	141.68	154.43	153.83	172.21	181.14	193.89	(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=	198.41	175.11	184.45	166.11	163.34	146.74	141.68	154.43	153.83	172.21	181.14	193.89	

Output from water heater (annual)$_{1…12}$ | 2031.34 | (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=	91.81	81.56	87.17	80.24	80.15	73.8	72.95	77.19	76.16	83.1	85.24	90.31	(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=	112.72	112.72	112.72	112.72	112.72	112.72	112.72	112.72	112.72	112.72	112.72	112.72	(66)

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

(67)m=	17.66	15.69	12.76	9.66	7.22	6.09	6.59	8.56	11.49	14.59	17.03	18.15	(67)

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

(68)m=	198.09	200.14	194.96	183.94	170.02	156.93	148.19	146.14	151.32	162.35	176.27	189.35	(68)

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

(69)m=	34.27	34.27	34.27	34.27	34.27	34.27	34.27	34.27	34.27	34.27	34.27	34.27	(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=	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	(71)

Water heating gains (Table 5)

(72)m=	123.4	121.38	117.17	111.45	107.73	102.5	98.05	103.75	105.77	111.7	118.38	121.38	(72)

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

(73)m=	395.97	394.02	381.7	361.86	341.78	322.34	309.65	315.26	325.4	345.45	368.49	385.7	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(75)
Northeast	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(75)
Northeast	0.9x	0.77	x	9.24	x	11.28	x	0.45	x	0.7	=	22.76	(75)
Northeast	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(75)
Northeast	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(75)
Northeast	0.9x	0.77	x	9.24	x	22.97	x	0.45	x	0.7	=	46.32	(75)
Northeast	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(75)
Northeast	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(75)
Northeast	0.9x	0.77	x	9.24	x	41.38	x	0.45	x	0.7	=	83.46	(75)
Northeast	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(75)
Northeast	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(75)
Northeast	0.9x	0.77	x	9.24	x	67.96	x	0.45	x	0.7	=	137.07	(75)
Northeast	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(75)
Northeast	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(75)
Northeast	0.9x	0.77	x	9.24	x	91.35	x	0.45	x	0.7	=	184.25	(75)
Northeast	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(75)
Northeast	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(75)
Northeast	0.9x	0.77	x	9.24	x	97.38	x	0.45	x	0.7	=	196.43	(75)
Northeast	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(75)
Northeast	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(75)
Northeast	0.9x	0.77	x	9.24	x	91.1	x	0.45	x	0.7	=	183.76	(75)
Northeast	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(75)
Northeast	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(75)
Northeast	0.9x	0.77	x	9.24	x	72.63	x	0.45	x	0.7	=	146.49	(75)
Northeast	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(75)
Northeast	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(75)
Northeast	0.9x	0.77	x	9.24	x	50.42	x	0.45	x	0.7	=	101.7	(75)
Northeast	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(75)
Northeast	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(75)
Northeast	0.9x	0.77	x	9.24	x	28.07	x	0.45	x	0.7	=	56.61	(75)
Northeast	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(75)
Northeast	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(75)
Northeast	0.9x	0.77	x	9.24	x	14.2	x	0.45	x	0.7	=	28.64	(75)
Northeast	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(75)
Northeast	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(75)
Northeast	0.9x	0.77	x	9.24	x	9.21	x	0.45	x	0.7	=	18.59	(75)
Southeast	0.9x	0.77	x	3.72	x	36.79	x	0.45	x	0.7	=	29.88	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	3.72	x	62.67	x	0.45	x	0.7	=	50.89	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast 0.9x	0.77	x	3.72	x	85.75	x	0.45	x	0.7	=	69.64	(77)
Southeast 0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast 0.9x	0.77	x	3.72	x	106.25	x	0.45	x	0.7	=	86.28	(77)
Southeast 0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast 0.9x	0.77	x	3.72	x	119.01	x	0.45	x	0.7	=	96.64	(77)
Southeast 0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast 0.9x	0.77	x	3.72	x	118.15	x	0.45	x	0.7	=	95.94	(77)
Southeast 0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast 0.9x	0.77	x	3.72	x	113.91	x	0.45	x	0.7	=	92.5	(77)
Southeast 0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast 0.9x	0.77	x	3.72	x	104.39	x	0.45	x	0.7	=	84.77	(77)
Southeast 0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast 0.9x	0.77	x	3.72	x	92.85	x	0.45	x	0.7	=	75.4	(77)
Southeast 0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast 0.9x	0.77	x	3.72	x	69.27	x	0.45	x	0.7	=	56.25	(77)
Southeast 0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast 0.9x	0.77	x	3.72	x	44.07	x	0.45	x	0.7	=	35.79	(77)
Southeast 0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast 0.9x	0.77	x	3.72	x	31.49	x	0.45	x	0.7	=	25.57	(77)
Southeast 0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)

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

(83)m=	84.12	154.83	242.49	351.81	440.93	458.36	433.33	363.69	279.85	179.38	102.86	70.63	(83)

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

(84)m=	480.09	548.85	624.19	713.66	782.71	780.71	742.98	678.95	605.24	524.83	471.35	456.33	(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=	0.95	0.93	0.88	0.79	0.66	0.5	0.38	0.42	0.64	0.84	0.93	0.96	(86)

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

(87)m=	19.13	19.39	19.81	20.32	20.7	20.91	20.97	20.96	20.8	20.3	19.64	19.09	(87)

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

(88)m=	20.1	20.1	20.11	20.12	20.12	20.13	20.13	20.14	20.13	20.12	20.12	20.11	(88)

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

(89)m=	0.95	0.92	0.87	0.77	0.62	0.44	0.31	0.35	0.58	0.81	0.92	0.95	(89)

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

(90)m=	17.59	17.97	18.57	19.29	19.79	20.05	20.11	20.1	19.93	19.27	18.34	17.54	(90)

fLA = Living area ÷ (4) = | 0.42 | (91)

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

(92)m=	18.24	18.57	19.09	19.72	20.17	20.41	20.47	20.46	20.29	19.7	18.88	18.19	(92)

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

(93)m=	18.24	18.57	19.09	19.72	20.17	20.41	20.47	20.46	20.29	19.7	18.88	18.19	(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=	0.93	0.9	0.85	0.75	0.62	0.46	0.34	0.38	0.59	0.8	0.9	0.94	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	445.37	493.86	529.91	537.95	484.01	359.03	249.05	257.55	358.29	419.96	423.87	426.78	(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=	959.51	938.05	861.42	729.44	569.24	384.38	256.29	268.03	412.48	611.9	796.64	951.48	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	382.52	298.49	246.64	137.88	63.41	0	0	0	0	142.8	268.4	390.37	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1930.51 (98)

Space heating requirement in kWh/m²/year 27.45 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1930.51	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2316.62	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2031.34	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2437.61	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.54	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

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Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		159.19	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	159.19	(331)
Energy for lighting (calculated in Appendix L)		311.88	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4495.22	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	881.23	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	24.67	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	905.9	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				905.9	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	82.62	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	161.86	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1			0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				771.48	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				10.97	(384)
EI rating (section 14)					91.04	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.49

Property Address: Block B - Mid Floor

Address : B, Block B, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.34	(1a) x	2.5	(2a) =	175.85	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.34	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	175.85	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			2.43		x1/[1/(1.2)+ 0.04]	=	2.78			(27)
Windows Type 2			2.43		x1/[1/(1.2)+ 0.04]	=	2.78			(27)
Windows Type 3			9.24		x1/[1/(1.2)+ 0.04]	=	10.58			(27)
Windows Type 4			3.72		x1/[1/(1.2)+ 0.04]	=	4.26			(27)
Windows Type 5			2.43		x1/[1/(1.2)+ 0.04]	=	2.78			(27)
Walls Type1	46.9	20.25	26.65	x	0.16	=	4.26			(29)
Walls Type2	28.62	1.91	26.72	x	0.15	=	4.02			(29)
Total area of elements, m²			75.53							(31)
Party wall			18.5	x	0	=	0			(32)
Party floor			70.34							(32a)
Party ceiling			70.34							(32b)

** 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) =	33.38	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	6236.58	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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	7.34	(36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 40.72 (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=	17.18	16.97	16.77	15.76	15.55	14.54	14.54	14.33	14.94	15.55	15.96	16.36	(38)

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

(39)m=	57.9	57.7	57.49	56.48	56.28	55.26	55.26	55.06	55.67	56.28	56.68	57.09	

Average = Sum(39)$_{1…12}$ /12= 56.43 (39)

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

(40)m=	0.82	0.82	0.82	0.8	0.8	0.79	0.79	0.78	0.79	0.8	0.81	0.81	

Average = Sum(40)$_{1…12}$ /12= 0.8 (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 2.25 (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 87.74 (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=	96.51	93.01	89.5	85.99	82.48	78.97	78.97	82.48	85.99	89.5	93.01	96.51	

Total = Sum(44)$_{1…12}$ = 1052.89 (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=	143.13	125.18	129.18	112.62	108.06	93.25	86.41	99.15	100.34	116.93	127.64	138.61	

Total = Sum(45)$_{1…12}$ = 1380.5 (45)

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

(46)m=	21.47	18.78	19.38	16.89	16.21	13.99	12.96	14.87	15.05	17.54	19.15	20.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	198.41	175.11	184.45	166.11	163.34	146.74	141.68	154.43	153.83	172.21	181.14	193.89	(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=	198.41	175.11	184.45	166.11	163.34	146.74	141.68	154.43	153.83	172.21	181.14	193.89	

Output from water heater (annual)$_{1...12}$ 2031.34 (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=	91.81	81.56	87.17	80.24	80.15	73.8	72.95	77.19	76.16	83.1	85.24	90.31	(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=	112.72	112.72	112.72	112.72	112.72	112.72	112.72	112.72	112.72	112.72	112.72	112.72	(66)

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

(67)m=	17.66	15.69	12.76	9.66	7.22	6.09	6.59	8.56	11.49	14.59	17.03	18.15	(67)

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

(68)m=	198.09	200.14	194.96	183.94	170.02	156.93	148.19	146.14	151.32	162.35	176.27	189.35	(68)

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

(69)m=	34.27	34.27	34.27	34.27	34.27	34.27	34.27	34.27	34.27	34.27	34.27	34.27	(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=	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	-90.17	(71)

Water heating gains (Table 5)

(72)m=	123.4	121.38	117.17	111.45	107.73	102.5	98.05	103.75	105.77	111.7	118.38	121.38	(72)

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

(73)m=	395.97	394.02	381.7	361.86	341.78	322.34	309.65	315.26	325.4	345.45	368.49	385.7	(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)	
Northeast	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(75)
Northeast	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(75)
Northeast	0.9x	0.77	x	9.24	x	11.28	x	0.45	x	0.7	=	22.76	(75)
Northeast	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(75)
Northeast	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(75)
Northeast	0.9x	0.77	x	9.24	x	22.97	x	0.45	x	0.7	=	46.32	(75)
Northeast	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(75)
Northeast	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(75)
Northeast	0.9x	0.77	x	9.24	x	41.38	x	0.45	x	0.7	=	83.46	(75)
Northeast	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(75)
Northeast	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(75)
Northeast	0.9x	0.77	x	9.24	x	67.96	x	0.45	x	0.7	=	137.07	(75)
Northeast	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(75)
Northeast	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(75)
Northeast	0.9x	0.77	x	9.24	x	91.35	x	0.45	x	0.7	=	184.25	(75)
Northeast	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(75)
Northeast	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(75)
Northeast	0.9x	0.77	x	9.24	x	97.38	x	0.45	x	0.7	=	196.43	(75)
Northeast	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(75)
Northeast	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(75)
Northeast	0.9x	0.77	x	9.24	x	91.1	x	0.45	x	0.7	=	183.76	(75)
Northeast	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(75)
Northeast	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(75)
Northeast	0.9x	0.77	x	9.24	x	72.63	x	0.45	x	0.7	=	146.49	(75)
Northeast	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(75)
Northeast	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(75)
Northeast	0.9x	0.77	x	9.24	x	50.42	x	0.45	x	0.7	=	101.7	(75)
Northeast	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(75)
Northeast	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(75)
Northeast	0.9x	0.77	x	9.24	x	28.07	x	0.45	x	0.7	=	56.61	(75)
Northeast	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(75)
Northeast	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(75)
Northeast	0.9x	0.77	x	9.24	x	14.2	x	0.45	x	0.7	=	28.64	(75)
Northeast	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(75)
Northeast	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(75)
Northeast	0.9x	0.77	x	9.24	x	9.21	x	0.45	x	0.7	=	18.59	(75)
Southeast	0.9x	0.77	x	3.72	x	36.79	x	0.45	x	0.7	=	29.88	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	3.72	x	62.67	x	0.45	x	0.7	=	50.89	(77)

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Southeast 0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast 0.9x	0.77	x	3.72	x	85.75	x	0.45	x	0.7	=	69.64	(77)
Southeast 0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast 0.9x	0.77	x	3.72	x	106.25	x	0.45	x	0.7	=	86.28	(77)
Southeast 0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast 0.9x	0.77	x	3.72	x	119.01	x	0.45	x	0.7	=	96.64	(77)
Southeast 0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast 0.9x	0.77	x	3.72	x	118.15	x	0.45	x	0.7	=	95.94	(77)
Southeast 0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast 0.9x	0.77	x	3.72	x	113.91	x	0.45	x	0.7	=	92.5	(77)
Southeast 0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast 0.9x	0.77	x	3.72	x	104.39	x	0.45	x	0.7	=	84.77	(77)
Southeast 0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast 0.9x	0.77	x	3.72	x	92.85	x	0.45	x	0.7	=	75.4	(77)
Southeast 0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast 0.9x	0.77	x	3.72	x	69.27	x	0.45	x	0.7	=	56.25	(77)
Southeast 0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast 0.9x	0.77	x	3.72	x	44.07	x	0.45	x	0.7	=	35.79	(77)
Southeast 0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast 0.9x	0.77	x	3.72	x	31.49	x	0.45	x	0.7	=	25.57	(77)
Southeast 0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)

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

(83)m=	84.12	154.83	242.49	351.81	440.93	458.36	433.33	363.69	279.85	179.38	102.86	70.63	(83)

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

(84)m=	480.09	548.85	624.19	713.66	782.71	780.71	742.98	678.95	605.24	524.83	471.35	456.33	(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=	0.95	0.92	0.86	0.75	0.6	0.44	0.32	0.36	0.58	0.81	0.92	0.95	(86)

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

(87)m=	19.53	19.78	20.15	20.57	20.84	20.96	20.99	20.98	20.9	20.53	19.97	19.49	(87)

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

(88)m=	20.23	20.24	20.24	20.25	20.25	20.27	20.27	20.27	20.26	20.25	20.25	20.24	(88)

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

(89)m=	0.94	0.91	0.85	0.73	0.56	0.39	0.27	0.31	0.53	0.78	0.91	0.95	(89)

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

(90)m=	18.25	18.61	19.14	19.73	20.07	20.23	20.26	20.26	20.16	19.69	18.9	18.2	(90)

fLA = Living area ÷ (4) = 0.42 (91)

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

(92)m=	18.79	19.1	19.56	20.08	20.4	20.53	20.56	20.56	20.47	20.04	19.35	18.74	(92)

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

(93)m=	18.79	19.1	19.56	20.08	20.4	20.53	20.56	20.56	20.47	20.04	19.35	18.74	(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=	0.92	0.89	0.83	0.72	0.57	0.41	0.29	0.33	0.54	0.77	0.89	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	443.17	488.84	518.63	513.05	444.83	317.38	216.51	225.13	327.19	405.71	419.35	425.1	(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=	838.95	819.44	751.1	631.6	489.36	327.96	219.08	229.09	354.45	531.46	694.52	830.26	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	294.46	222.16	172.95	85.36	33.13	0	0	0	0	93.56	198.13	301.44	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1401.19 (98)

Space heating requirement in kWh/m²/year 19.92 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.			
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1401.19	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1681.43	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2031.34	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2437.61	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.19	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

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Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		159.19	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	159.19	(331)
Energy for lighting (calculated in Appendix L)		311.88	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3860.03	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	763.49	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.38	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	784.87	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				784.87	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	82.62	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	161.86	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1			0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				650.45	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				9.25	(384)
EI rating (section 14)					92.44	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block C - Ground Floor

Address : C, Block C, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	100.02	(1a) x	2.5	(2a) =	250.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	100.02	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		250.05	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			4	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 2			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 3			6	x1/[1/(1.2)+ 0.04]		=	6.87			(27)
Windows Type 4			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 5			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 6			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Floor			100.02	x	0.1	=	10.002			(28)
Walls Type1	59.67	22.2	37.47	x	0.16	=	6			(29)
Walls Type2	35.53	1.91	33.62	x	0.15	=	5.05			(29)
Total area of elements, m²			195.22							(31)
Party wall			24.23	x	0	=	0			(32)
Party ceiling			100.02							(32b)

** 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) = 48.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 15732.73 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 13.97 (36)

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

Total fabric heat loss (33) + (36) = 62.35 (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=	24.42	24.14	23.85	22.4	22.11	20.67	20.67	20.38	21.25	22.11	22.69	23.27	(38)

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

(39)m=	86.77	86.48	86.2	84.75	84.46	83.02	83.02	82.73	83.6	84.46	85.04	85.62	

Average = $Sum(39)_{1...12}$ /12= 84.68 (39)

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

(40)m=	0.87	0.86	0.86	0.85	0.84	0.83	0.83	0.83	0.84	0.84	0.85	0.86	

Average = $Sum(40)_{1...12}$ /12= 0.85 (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 2.74 (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 99.27 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	109.19	105.22	101.25	97.28	93.31	89.34	89.34	93.31	97.28	101.25	105.22	109.19	

Total = $Sum(44)_{1...12}$ = 1191.22 (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=	161.93	141.63	146.15	127.41	122.26	105.5	97.76	112.18	113.52	132.3	144.41	156.82	

Total = $Sum(45)_{1...12}$ = 1561.87 (45)

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

(46)m=	24.29	21.24	21.92	19.11	18.34	15.82	14.66	16.83	17.03	19.84	21.66	23.52	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	217.21	191.56	201.42	180.91	177.53	158.99	153.04	167.46	167.01	187.57	197.91	212.1	(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=	217.21	191.56	201.42	180.91	177.53	158.99	153.04	167.46	167.01	187.57	197.91	212.1

Output from water heater (annual)1…12 — 2212.71 (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=	98.06	87.03	92.82	85.16	84.87	77.87	76.73	81.52	80.54	88.21	90.81	96.37	(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=	136.99	136.99	136.99	136.99	136.99	136.99	136.99	136.99	136.99	136.99	136.99	136.99	(66)

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

(67)m=	22.86	20.3	16.51	12.5	9.34	7.89	8.52	11.08	14.87	18.88	22.04	23.49	(67)

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

(68)m=	256.36	259.02	252.32	238.05	220.03	203.1	191.79	189.13	195.83	210.1	228.12	245.05	(68)

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

(69)m=	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	(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=	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	(71)

Water heating gains (Table 5)

(72)m=	131.81	129.51	124.75	118.28	114.08	108.16	103.13	109.57	111.86	118.56	126.13	129.52	(72)

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

(73)m=	475.12	472.93	457.67	432.92	407.54	383.24	367.53	373.87	386.66	411.64	440.38	462.16	(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)	
Southwest	0.9x	0.77	x	3.24	x	36.79		0.45	x	0.7	=	26.02	(79)
Southwest	0.9x	0.77	x	3.24	x	36.79		0.45	x	0.7	=	26.02	(79)
Southwest	0.9x	0.77	x	3.24	x	36.79		0.45	x	0.7	=	26.02	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.45	x	0.7	=	44.33	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.45	x	0.7	=	44.33	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.45	x	0.7	=	44.33	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.45	x	0.7	=	60.65	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.45	x	0.7	=	60.65	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.45	x	0.7	=	60.65	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.45	x	0.7	=	75.15	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.45	x	0.7	=	75.15	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.45	x	0.7	=	75.15	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.45	x	0.7	=	84.17	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.45	x	0.7	=	84.17	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.45	x	0.7	=	84.17	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.45	x	0.7	=	83.56	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.45	x	0.7	=	83.56	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.45	x	0.7	=	83.56	(79)
Southwest	0.9x	0.77	x	3.24	x	113.91		0.45	x	0.7	=	80.57	(79)
Southwest	0.9x	0.77	x	3.24	x	113.91		0.45	x	0.7	=	80.57	(79)
Southwest	0.9x	0.77	x	3.24	x	113.91		0.45	x	0.7	=	80.57	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.45	x	0.7	=	73.83	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.45	x	0.7	=	73.83	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.45	x	0.7	=	73.83	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.45	x	0.7	=	65.67	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.45	x	0.7	=	65.67	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.45	x	0.7	=	65.67	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.45	x	0.7	=	48.99	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.45	x	0.7	=	48.99	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.45	x	0.7	=	48.99	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.45	x	0.7	=	31.17	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.45	x	0.7	=	31.17	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.45	x	0.7	=	31.17	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.45	x	0.7	=	22.27	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.45	x	0.7	=	22.27	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.45	x	0.7	=	22.27	(79)
Northwest	0.9x	0.77	x	3.24	x	11.28	x	0.45	x	0.7	=	7.98	(81)
Northwest	0.9x	0.77	x	3.24	x	11.28	x	0.45	x	0.7	=	7.98	(81)
Northwest	0.9x	0.77	x	6	x	11.28	x	0.45	x	0.7	=	14.78	(81)

Northwest 0.9x	0.77	x	3.24	x	22.97	x	0.45	x	0.7	=	16.24	(81)
Northwest 0.9x	0.77	x	3.24	x	22.97	x	0.45	x	0.7	=	16.24	(81)
Northwest 0.9x	0.77	x	6	x	22.97	x	0.45	x	0.7	=	30.08	(81)
Northwest 0.9x	0.77	x	3.24	x	41.38	x	0.45	x	0.7	=	29.27	(81)
Northwest 0.9x	0.77	x	3.24	x	41.38	x	0.45	x	0.7	=	29.27	(81)
Northwest 0.9x	0.77	x	6	x	41.38	x	0.45	x	0.7	=	54.2	(81)
Northwest 0.9x	0.77	x	3.24	x	67.96	x	0.45	x	0.7	=	48.06	(81)
Northwest 0.9x	0.77	x	3.24	x	67.96	x	0.45	x	0.7	=	48.06	(81)
Northwest 0.9x	0.77	x	6	x	67.96	x	0.45	x	0.7	=	89.01	(81)
Northwest 0.9x	0.77	x	3.24	x	91.35	x	0.45	x	0.7	=	64.61	(81)
Northwest 0.9x	0.77	x	3.24	x	91.35	x	0.45	x	0.7	=	64.61	(81)
Northwest 0.9x	0.77	x	6	x	91.35	x	0.45	x	0.7	=	119.64	(81)
Northwest 0.9x	0.77	x	3.24	x	97.38	x	0.45	x	0.7	=	68.88	(81)
Northwest 0.9x	0.77	x	3.24	x	97.38	x	0.45	x	0.7	=	68.88	(81)
Northwest 0.9x	0.77	x	6	x	97.38	x	0.45	x	0.7	=	127.55	(81)
Northwest 0.9x	0.77	x	3.24	x	91.1	x	0.45	x	0.7	=	64.43	(81)
Northwest 0.9x	0.77	x	3.24	x	91.1	x	0.45	x	0.7	=	64.43	(81)
Northwest 0.9x	0.77	x	6	x	91.1	x	0.45	x	0.7	=	119.32	(81)
Northwest 0.9x	0.77	x	3.24	x	72.63	x	0.45	x	0.7	=	51.37	(81)
Northwest 0.9x	0.77	x	3.24	x	72.63	x	0.45	x	0.7	=	51.37	(81)
Northwest 0.9x	0.77	x	6	x	72.63	x	0.45	x	0.7	=	95.12	(81)
Northwest 0.9x	0.77	x	3.24	x	50.42	x	0.45	x	0.7	=	35.66	(81)
Northwest 0.9x	0.77	x	3.24	x	50.42	x	0.45	x	0.7	=	35.66	(81)
Northwest 0.9x	0.77	x	6	x	50.42	x	0.45	x	0.7	=	66.04	(81)
Northwest 0.9x	0.77	x	3.24	x	28.07	x	0.45	x	0.7	=	19.85	(81)
Northwest 0.9x	0.77	x	3.24	x	28.07	x	0.45	x	0.7	=	19.85	(81)
Northwest 0.9x	0.77	x	6	x	28.07	x	0.45	x	0.7	=	36.76	(81)
Northwest 0.9x	0.77	x	3.24	x	14.2	x	0.45	x	0.7	=	10.04	(81)
Northwest 0.9x	0.77	x	3.24	x	14.2	x	0.45	x	0.7	=	10.04	(81)
Northwest 0.9x	0.77	x	6	x	14.2	x	0.45	x	0.7	=	18.59	(81)
Northwest 0.9x	0.77	x	3.24	x	9.21	x	0.45	x	0.7	=	6.52	(81)
Northwest 0.9x	0.77	x	3.24	x	9.21	x	0.45	x	0.7	=	6.52	(81)
Northwest 0.9x	0.77	x	6	x	9.21	x	0.45	x	0.7	=	12.07	(81)

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

(83)m=	108.81	195.55	294.68	410.58	501.38	516	489.88	419.36	334.38	223.44	132.19	91.91	(83)

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

(84)m=	583.93	668.48	752.36	843.5	908.92	899.24	857.42	793.23	721.04	635.08	572.56	554.07	(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

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(86)m=	0.96	0.95	0.91	0.83	0.7	0.54	0.41	0.46	0.67	0.87	0.95	0.97	(86)

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

(87)m=	19.25	19.49	19.88	20.35	20.71	20.91	20.97	20.96	20.81	20.35	19.72	19.21	(87)

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

(88)m=	20.2	20.2	20.2	20.21	20.21	20.23	20.23	20.23	20.22	20.21	20.21	20.21	(88)

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

(89)m=	0.96	0.94	0.9	0.81	0.67	0.49	0.34	0.39	0.62	0.85	0.94	0.97	(89)

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

(90)m=	17.82	18.18	18.73	19.4	19.88	20.14	20.21	20.2	20.03	19.41	18.52	17.77	(90)

fLA = Living area ÷ (4) = 0.32 (91)

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

(92)m=	18.27	18.59	19.09	19.7	20.14	20.39	20.45	20.44	20.28	19.71	18.9	18.23	(92)

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

(93)m=	18.27	18.59	19.09	19.7	20.14	20.39	20.45	20.44	20.28	19.71	18.9	18.23	(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=	0.94	0.92	0.88	0.79	0.66	0.5	0.36	0.41	0.62	0.83	0.92	0.95	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	551.71	615.22	659.18	667.42	602.27	448.61	311.24	322.28	450.24	526.3	526.88	527.17	(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=	1212.45	1184.39	1085.36	915.46	713.21	480.35	319.63	334.38	516.7	769.18	1003.76	1200.94	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	491.59	382.49	317.08	178.59	82.54	0	0	0	0	180.7	343.35	501.28	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2477.62 (98)

Space heating requirement in kWh/m²/year 24.77 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)

Space heating **kWh/year**

Annual space heating requirement 2477.62

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2973.15	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2212.71	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2655.26	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	56.28	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		226.36	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	226.36	(331)
Energy for lighting (calculated in Appendix L)		403.66	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5528.35	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1404.4	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	29.21	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1433.61	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1433.61	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	117.48	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	209.5	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				1381.68	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				13.81	(384)
EI rating (section 14)					87.23	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block C - Mid Floor

Address : C, Block C, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	100.02	(1a) x	2.5	(2a) =	250.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	100.02	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	250.05	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 2			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 3			6	x1/[1/(1.2)+ 0.04]		=	6.87			(27)
Windows Type 4			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 5			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 6			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Walls Type1	59.67	22.2	37.47	x	0.16	=	6			(29)
Walls Type2	35.53	1.91	33.62	x	0.15	=	5.05			(29)
Total area of elements, m²			95.2							(31)
Party wall			24.23	x	0	=	0			(32)
Party floor			100.02							(32a)
Party ceiling			100.02							(32b)

** 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) =	38.38	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	8731.33	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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	9	(36)

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

Total fabric heat loss (33) + (36) = 47.38 (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=	24.42	24.14	23.85	22.4	22.11	20.67	20.67	20.38	21.25	22.11	22.69	23.27	(38)

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

(39)m=	71.8	71.51	71.23	69.78	69.49	68.05	68.05	67.76	68.63	69.49	70.07	70.65	

Average = Sum(39)$_{1...12}$ /12= 69.71 (39)

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

(40)m=	0.72	0.72	0.71	0.7	0.69	0.68	0.68	0.68	0.69	0.69	0.7	0.71	

Average = Sum(40)$_{1...12}$ /12= 0.7 (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 2.74 (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 99.27 (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=	109.19	105.22	101.25	97.28	93.31	89.34	89.34	93.31	97.28	101.25	105.22	109.19	

Total = Sum(44)$_{1...12}$ = 1191.22 (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=	161.93	141.63	146.15	127.41	122.26	105.5	97.76	112.18	113.52	132.3	144.41	156.82	

Total = Sum(45)$_{1...12}$ = 1561.87 (45)

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

(46)m=	24.29	21.24	21.92	19.11	18.34	15.82	14.66	16.83	17.03	19.84	21.66	23.52	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	217.21	191.56	201.42	180.91	177.53	158.99	153.04	167.46	167.01	187.57	197.91	212.1	(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=	217.21	191.56	201.42	180.91	177.53	158.99	153.04	167.46	167.01	187.57	197.91	212.1	

Output from water heater (annual)$_{1...12}$ — 2212.71 (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=	98.06	87.03	92.82	85.16	84.87	77.87	76.73	81.52	80.54	88.21	90.81	96.37	(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=	136.99	136.99	136.99	136.99	136.99	136.99	136.99	136.99	136.99	136.99	136.99	136.99	(66)

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

(67)m=	22.86	20.3	16.51	12.5	9.34	7.89	8.52	11.08	14.87	18.88	22.04	23.49	(67)

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

(68)m=	256.36	259.02	252.32	238.05	220.03	203.1	191.79	189.13	195.83	210.1	228.12	245.05	(68)

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

(69)m=	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	(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=	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	-109.59	(71)

Water heating gains (Table 5)

(72)m=	131.81	129.51	124.75	118.28	114.08	108.16	103.13	109.57	111.86	118.56	126.13	129.52	(72)

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

(73)m=	475.12	472.93	457.67	432.92	407.54	383.24	367.53	373.87	386.66	411.64	440.38	462.16	(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)	
Southwest	0.9x	0.77	x	3.24	x	36.79		0.45	x	0.7	=	26.02	(79)
Southwest	0.9x	0.77	x	3.24	x	36.79		0.45	x	0.7	=	26.02	(79)
Southwest	0.9x	0.77	x	3.24	x	36.79		0.45	x	0.7	=	26.02	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.45	x	0.7	=	44.33	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.45	x	0.7	=	44.33	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.45	x	0.7	=	44.33	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.45	x	0.7	=	60.65	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.45	x	0.7	=	60.65	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.45	x	0.7	=	60.65	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.45	x	0.7	=	75.15	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.45	x	0.7	=	75.15	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.45	x	0.7	=	75.15	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.45	x	0.7	=	84.17	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.45	x	0.7	=	84.17	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.45	x	0.7	=	84.17	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.45	x	0.7	=	83.56	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.45	x	0.7	=	83.56	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.45	x	0.7	=	83.56	(79)
Southwest	0.9x	0.77	x	3.24	x	113.91		0.45	x	0.7	=	80.57	(79)
Southwest	0.9x	0.77	x	3.24	x	113.91		0.45	x	0.7	=	80.57	(79)
Southwest	0.9x	0.77	x	3.24	x	113.91		0.45	x	0.7	=	80.57	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.45	x	0.7	=	73.83	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.45	x	0.7	=	73.83	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.45	x	0.7	=	73.83	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.45	x	0.7	=	65.67	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.45	x	0.7	=	65.67	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.45	x	0.7	=	65.67	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.45	x	0.7	=	48.99	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.45	x	0.7	=	48.99	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.45	x	0.7	=	48.99	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.45	x	0.7	=	31.17	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.45	x	0.7	=	31.17	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.45	x	0.7	=	31.17	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.45	x	0.7	=	22.27	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.45	x	0.7	=	22.27	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.45	x	0.7	=	22.27	(79)
Northwest	0.9x	0.77	x	3.24	x	11.28	x	0.45	x	0.7	=	7.98	(81)
Northwest	0.9x	0.77	x	3.24	x	11.28	x	0.45	x	0.7	=	7.98	(81)
Northwest	0.9x	0.77	x	6	x	11.28	x	0.45	x	0.7	=	14.78	(81)

Northwest 0.9x	0.77	x	3.24	x	22.97	x	0.45	x	0.7	=	16.24	(81)
Northwest 0.9x	0.77	x	3.24	x	22.97	x	0.45	x	0.7	=	16.24	(81)
Northwest 0.9x	0.77	x	6	x	22.97	x	0.45	x	0.7	=	30.08	(81)
Northwest 0.9x	0.77	x	3.24	x	41.38	x	0.45	x	0.7	=	29.27	(81)
Northwest 0.9x	0.77	x	3.24	x	41.38	x	0.45	x	0.7	=	29.27	(81)
Northwest 0.9x	0.77	x	6	x	41.38	x	0.45	x	0.7	=	54.2	(81)
Northwest 0.9x	0.77	x	3.24	x	67.96	x	0.45	x	0.7	=	48.06	(81)
Northwest 0.9x	0.77	x	3.24	x	67.96	x	0.45	x	0.7	=	48.06	(81)
Northwest 0.9x	0.77	x	6	x	67.96	x	0.45	x	0.7	=	89.01	(81)
Northwest 0.9x	0.77	x	3.24	x	91.35	x	0.45	x	0.7	=	64.61	(81)
Northwest 0.9x	0.77	x	3.24	x	91.35	x	0.45	x	0.7	=	64.61	(81)
Northwest 0.9x	0.77	x	6	x	91.35	x	0.45	x	0.7	=	119.64	(81)
Northwest 0.9x	0.77	x	3.24	x	97.38	x	0.45	x	0.7	=	68.88	(81)
Northwest 0.9x	0.77	x	3.24	x	97.38	x	0.45	x	0.7	=	68.88	(81)
Northwest 0.9x	0.77	x	6	x	97.38	x	0.45	x	0.7	=	127.55	(81)
Northwest 0.9x	0.77	x	3.24	x	91.1	x	0.45	x	0.7	=	64.43	(81)
Northwest 0.9x	0.77	x	3.24	x	91.1	x	0.45	x	0.7	=	64.43	(81)
Northwest 0.9x	0.77	x	6	x	91.1	x	0.45	x	0.7	=	119.32	(81)
Northwest 0.9x	0.77	x	3.24	x	72.63	x	0.45	x	0.7	=	51.37	(81)
Northwest 0.9x	0.77	x	3.24	x	72.63	x	0.45	x	0.7	=	51.37	(81)
Northwest 0.9x	0.77	x	6	x	72.63	x	0.45	x	0.7	=	95.12	(81)
Northwest 0.9x	0.77	x	3.24	x	50.42	x	0.45	x	0.7	=	35.66	(81)
Northwest 0.9x	0.77	x	3.24	x	50.42	x	0.45	x	0.7	=	35.66	(81)
Northwest 0.9x	0.77	x	6	x	50.42	x	0.45	x	0.7	=	66.04	(81)
Northwest 0.9x	0.77	x	3.24	x	28.07	x	0.45	x	0.7	=	19.85	(81)
Northwest 0.9x	0.77	x	3.24	x	28.07	x	0.45	x	0.7	=	19.85	(81)
Northwest 0.9x	0.77	x	6	x	28.07	x	0.45	x	0.7	=	36.76	(81)
Northwest 0.9x	0.77	x	3.24	x	14.2	x	0.45	x	0.7	=	10.04	(81)
Northwest 0.9x	0.77	x	3.24	x	14.2	x	0.45	x	0.7	=	10.04	(81)
Northwest 0.9x	0.77	x	6	x	14.2	x	0.45	x	0.7	=	18.59	(81)
Northwest 0.9x	0.77	x	3.24	x	9.21	x	0.45	x	0.7	=	6.52	(81)
Northwest 0.9x	0.77	x	3.24	x	9.21	x	0.45	x	0.7	=	6.52	(81)
Northwest 0.9x	0.77	x	6	x	9.21	x	0.45	x	0.7	=	12.07	(81)

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

(83)m=	108.81	195.55	294.68	410.58	501.38	516	489.88	419.36	334.38	223.44	132.19	91.91	(83)

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

(84)m=	583.93	668.48	752.36	843.5	908.92	899.24	857.42	793.23	721.04	635.08	572.56	554.07	(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

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(86)m=	0.96	0.94	0.89	0.79	0.64	0.47	0.34	0.39	0.6	0.83	0.93	0.97	(86)

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

(87)m=	19.66	19.89	20.23	20.62	20.86	20.97	20.99	20.99	20.92	20.59	20.07	19.62	(87)

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

(88)m=	20.33	20.33	20.33	20.34	20.35	20.36	20.36	20.36	20.35	20.35	20.34	20.34	(88)

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

(89)m=	0.95	0.93	0.87	0.76	0.6	0.42	0.3	0.33	0.56	0.81	0.93	0.96	(89)

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

(90)m=	18.5	18.84	19.32	19.86	20.18	20.33	20.35	20.35	20.27	19.84	19.11	18.46	(90)

fLA = Living area ÷ (4) = 0.32 (91)

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

(92)m=	18.87	19.17	19.61	20.1	20.4	20.53	20.55	20.55	20.47	20.08	19.41	18.83	(92)

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

(93)m=	18.87	19.17	19.61	20.1	20.4	20.53	20.55	20.55	20.47	20.08	19.41	18.83	(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=	0.94	0.91	0.86	0.75	0.61	0.44	0.31	0.35	0.56	0.8	0.91	0.95	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	549.53	609.56	645.71	636.24	551.05	391.95	266.63	277.57	407.37	507.88	521.77	525.59	(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=	1045.95	1020.73	933.67	781.63	604.38	403.48	269.12	281.39	437.28	658.63	862.85	1033.37	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	369.33	276.31	214.24	104.68	39.67	0	0	0	0	112.15	245.58	377.79	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1739.76 (98)

Space heating requirement in kWh/m²/year 17.39 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump 1 (303a)

Fraction of total space heat from Community heat pump (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.2 (306)

Space heating **kWh/year**

Annual space heating requirement 1739.76

DER WorkSheet: New dwelling design stage

Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2087.72	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2212.71	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2655.26	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.43	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		226.36	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	226.36	(331)
Energy for lighting (calculated in Appendix L)		403.66	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4642.91	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1183.46	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	24.62	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1208.08	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1208.08	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	117.48	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	209.5	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				1156.15	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				11.56	(384)
EI rating (section 14)					89.32	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block C - Top Floor

Address : C, Block C, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54.95	(1a) x	2.5	(2a) =	137.38	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.95	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	137.38	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			6.72	x1/[1/(1.2)+ 0.04]		=	7.69			(27)
Windows Type 2			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 3			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 4			6.72	x1/[1/(1.2)+ 0.04]		=	7.69			(27)
Walls Type1	32.7	18.3	14.4	x	0.16	=	2.3			(29)
Walls Type2	32.7	1.91	30.79	x	0.15	=	4.63			(29)
Roof	54.95	0	54.95	x	0.1	=	5.5			(30)
Total area of elements, m²			120.35							(31)
Party wall			21.15	x	0	=	0			(32)
Party floor			54.95							(32a)

* *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) =	35.29	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	4051.01	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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		19.61	(36)

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

Total fabric heat loss	(33) + (36) =	54.91	(37)

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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=	13.42	13.26	13.1	12.31	12.15	11.36	11.36	11.2	11.67	12.15	12.47	12.78	(38)

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

(39)m=	68.33	68.17	68.01	67.22	67.06	66.26	66.26	66.1	66.58	67.06	67.37	67.69	

Average = Sum(39)$_{1\ldots12}$ /12= 67.18 (39)

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

(40)m=	1.24	1.24	1.24	1.22	1.22	1.21	1.21	1.2	1.21	1.22	1.23	1.23	

Average = Sum(40)$_{1\ldots12}$ /12= 1.22 (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 1.84 (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 77.8 (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=	85.58	82.47	79.36	76.25	73.13	70.02	70.02	73.13	76.25	79.36	82.47	85.58	

Total = Sum(44)$_{1\ldots12}$ = 933.63 (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=	126.92	111	114.54	99.86	95.82	82.69	76.62	87.92	88.97	103.69	113.19	122.91	

Total = Sum(45)$_{1\ldots12}$ = 1224.14 (45)

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

(46)m=	19.04	16.65	17.18	14.98	14.37	12.4	11.49	13.19	13.35	15.55	16.98	18.44	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	182.19	160.93	169.82	153.36	151.1	136.18	131.9	143.2	142.47	158.97	166.68	178.19	(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=	182.19	160.93	169.82	153.36	151.1	136.18	131.9	143.2	142.47	158.97	166.68	178.19

Output from water heater (annual)$_{1...12}$ | 1874.98 | (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=	86.42	76.85	82.31	76	76.08	70.29	69.7	73.46	72.38	78.7	80.43	85.09	(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=	91.79	91.79	91.79	91.79	91.79	91.79	91.79	91.79	91.79	91.79	91.79	91.79	(66)

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

(67)m=	14.27	12.67	10.31	7.8	5.83	4.92	5.32	6.92	9.28	11.79	13.76	14.67	(67)

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

(68)m=	160.06	161.72	157.53	148.62	137.37	126.8	119.74	118.08	122.27	131.18	142.42	152.99	(68)

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

(69)m=	32.18	32.18	32.18	32.18	32.18	32.18	32.18	32.18	32.18	32.18	32.18	32.18	(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=	-73.44	-73.44	-73.44	-73.44	-73.44	-73.44	-73.44	-73.44	-73.44	-73.44	-73.44	-73.44	(71)

Water heating gains (Table 5)

(72)m=	116.16	114.36	110.63	105.55	102.26	97.62	93.68	98.73	100.53	105.78	111.71	114.37	(72)

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

(73)m=	341.02	339.29	329.01	312.52	296.01	279.89	269.28	274.27	282.61	299.28	318.43	332.57	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	6.72	x	36.79	x	0.45	x	0.7	=	53.97	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	6.72	x	36.79	x	0.45	x	0.7	=	53.97	(77)
Southeast	0.9x	0.77	x	6.72	x	62.67	x	0.45	x	0.7	=	91.94	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	6.72	x	62.67	x	0.45	x	0.7	=	91.94	(77)
Southeast	0.9x	0.77	x	6.72	x	85.75	x	0.45	x	0.7	=	125.79	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	6.72	x	85.75	x	0.45	x	0.7	=	125.79	(77)
Southeast	0.9x	0.77	x	6.72	x	106.25	x	0.45	x	0.7	=	155.86	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	6.72	x	106.25	x	0.45	x	0.7	=	155.86	(77)
Southeast	0.9x	0.77	x	6.72	x	119.01	x	0.45	x	0.7	=	174.58	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	6.72	x	119.01	x	0.45	x	0.7	=	174.58	(77)
Southeast	0.9x	0.77	x	6.72	x	118.15	x	0.45	x	0.7	=	173.32	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	6.72	x	118.15	x	0.45	x	0.7	=	173.32	(77)
Southeast	0.9x	0.77	x	6.72	x	113.91	x	0.45	x	0.7	=	167.1	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	6.72	x	113.91	x	0.45	x	0.7	=	167.1	(77)
Southeast	0.9x	0.77	x	6.72	x	104.39	x	0.45	x	0.7	=	153.13	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	6.72	x	104.39	x	0.45	x	0.7	=	153.13	(77)
Southeast	0.9x	0.77	x	6.72	x	92.85	x	0.45	x	0.7	=	136.21	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	6.72	x	92.85	x	0.45	x	0.7	=	136.21	(77)
Southeast	0.9x	0.77	x	6.72	x	69.27	x	0.45	x	0.7	=	101.61	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	6.72	x	69.27	x	0.45	x	0.7	=	101.61	(77)
Southeast	0.9x	0.77	x	6.72	x	44.07	x	0.45	x	0.7	=	64.65	(77)

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Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	6.72	x	44.07	x	0.45	x	0.7	=	64.65	(77)
Southeast	0.9x	0.77	x	6.72	x	31.49	x	0.45	x	0.7	=	46.19	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	6.72	x	31.49	x	0.45	x	0.7	=	46.19	(77)

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

(83)m=	146.98	250.37	342.56	424.45	475.42	471.99	455.04	417.02	370.92	276.71	176.05	125.79	(83)

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

(84)m=	488.01	589.66	671.57	736.97	771.43	751.87	724.32	691.28	653.54	575.99	494.48	458.35	(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=	0.93	0.89	0.83	0.75	0.64	0.5	0.38	0.41	0.58	0.78	0.89	0.94	(86)

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

(87)m=	18.83	19.19	19.66	20.17	20.58	20.84	20.94	20.93	20.75	20.21	19.43	18.76	(87)

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

(88)m=	19.89	19.89	19.89	19.9	19.9	19.92	19.92	19.92	19.91	19.9	19.9	19.89	(88)

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

(89)m=	0.92	0.87	0.81	0.72	0.59	0.43	0.29	0.32	0.52	0.74	0.88	0.93	(89)

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

(90)m=	17.04	17.55	18.2	18.92	19.45	19.78	19.88	19.87	19.68	18.99	17.91	16.94	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

(92)m=	17.77	18.22	18.8	19.43	19.91	20.21	20.31	20.3	20.12	19.49	18.53	17.69	(92)

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

(93)m=	17.77	18.22	18.8	19.43	19.91	20.21	20.31	20.3	20.12	19.49	18.53	17.69	(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=	0.89	0.85	0.79	0.7	0.59	0.45	0.32	0.35	0.53	0.73	0.85	0.9	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	434.96	499.16	528.74	516.54	453.61	337.51	235.36	244.37	345.88	419.33	420.73	413.68	(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=	920.4	908.1	836.34	707.93	550.76	371.9	246.12	258.03	400.58	596.32	770.27	912.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	361.16	274.81	228.86	137.8	72.28	0	0	0	0	131.68	251.67	371.39	

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	Total per year (kWh/year) = Sum(98)1...5,9...12 =	1829.65	(98)
Space heating requirement in kWh/m²/year		33.3	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1829.65	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2195.58	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1874.98	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2249.97	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	44.46	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		117.32	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	117.32	(331)
Energy for lighting (calculated in Appendix L)		252	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4084.8	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1109.25	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	23.07	(372)

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1132.32	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1132.32	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	60.89	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	130.79	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =			945.09	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.2	(384)
EI rating (section 14)				87.33	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block D - Ground Floor

Address : D, Block D, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	89.26	(1a) x	2.5	(2a) =	223.15	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	89.26	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	223.15	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Windows Type 2			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 3			4.2	x1/[1/(1.2)+ 0.04]		=	4.81			(27)
Windows Type 4			6	x1/[1/(1.2)+ 0.04]		=	6.87			(27)
Windows Type 5			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 6			4.08	x1/[1/(1.2)+ 0.04]		=	4.67			(27)
Windows Type 7			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Floor			89.26	x	0.1	=	8.926001			(28)
Walls Type1	66	23.82	42.18	x	0.16	=	6.75			(29)
Walls Type2	38.9	1.91	36.99	x	0.15	=	5.56			(29)
Total area of elements, m²			194.16							(31)
Party wall			15.85	x	0	=	0			(32)
Party ceiling			89.26							(32b)

** 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) =	50.42	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	13922.18	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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 | 14.23 | (36)

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

Total fabric heat loss (33) + (36) = | 64.65 | (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=	21.8	21.54	21.28	19.99	19.74	18.45	18.45	18.19	18.96	19.74	20.25	20.77	(38)

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

(39)m=	86.45	86.19	85.93	84.64	84.39	83.1	83.1	82.84	83.61	84.39	84.9	85.42	

Average = $Sum(39)_{1...12}$ /12= | 84.58 | (39)

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

(40)m=	0.97	0.97	0.96	0.95	0.95	0.93	0.93	0.93	0.94	0.95	0.95	0.96

Average = $Sum(40)_{1...12}$ /12= | 0.95 | (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 | 2.62 | (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 | 96.32 | (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	105.95	102.1	98.24	94.39	90.54	86.69	86.69	90.54	94.39	98.24	102.1	105.95

Total = $Sum(44)_{1...12}$ = | 1155.8 | (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=	157.12	137.42	141.8	123.63	118.62	102.36	94.85	108.85	110.15	128.36	140.12	152.16

Total = $Sum(45)_{1...12}$ = | 1515.44 | (45)

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

(46)m=	23.57	20.61	21.27	18.54	17.79	15.35	14.23	16.33	16.52	19.25	21.02	22.82	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (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) = | 110 | (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0.02 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 1.03 | (52)

Temperature factor from Table 2b | 0.6 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.03	(54)
Enter (50) or (54) in (55)		1.03	(55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	212.4	187.34	197.08	177.12	173.9	155.86	150.13	164.12	163.64	183.64	193.61	207.44	(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=	212.4	187.34	197.08	177.12	173.9	155.86	150.13	164.12	163.64	183.64	193.61	207.44	

Output from water heater (annual)$_{1...12}$ 2166.28 (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=	96.46	85.63	91.37	83.9	83.66	76.83	75.76	80.41	79.42	86.9	89.38	94.82	(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=	130.77	130.77	130.77	130.77	130.77	130.77	130.77	130.77	130.77	130.77	130.77	130.77	(66)

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

(67)m=	21.19	18.82	15.31	11.59	8.66	7.31	7.9	10.27	13.79	17.51	20.43	21.78	(67)

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

(68)m=	237.71	240.18	233.96	220.73	204.02	188.32	177.83	175.37	181.58	194.82	211.52	227.22	(68)

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

(69)m=	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	(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=	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	(71)

Water heating gains (Table 5)

(72)m=	129.66	127.43	122.81	116.53	112.45	106.71	101.83	108.08	110.3	116.8	124.15	127.44	(72)

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

(73)m=	450.79	448.66	434.31	411.08	387.37	364.58	349.8	355.95	367.91	391.36	418.33	438.67	(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)	
Northeast	0.9x	0.77	x	1.44	x	11.28	x	0.45	x	0.7	=	3.55	(75)
Northeast	0.9x	0.77	x	4.08	x	11.28	x	0.45	x	0.7	=	10.05	(75)
Northeast	0.9x	0.77	x	1.44	x	22.97	x	0.45	x	0.7	=	7.22	(75)
Northeast	0.9x	0.77	x	4.08	x	22.97	x	0.45	x	0.7	=	20.46	(75)
Northeast	0.9x	0.77	x	1.44	x	41.38	x	0.45	x	0.7	=	13.01	(75)
Northeast	0.9x	0.77	x	4.08	x	41.38	x	0.45	x	0.7	=	36.85	(75)
Northeast	0.9x	0.77	x	1.44	x	67.96	x	0.45	x	0.7	=	21.36	(75)
Northeast	0.9x	0.77	x	4.08	x	67.96	x	0.45	x	0.7	=	60.52	(75)
Northeast	0.9x	0.77	x	1.44	x	91.35	x	0.45	x	0.7	=	28.71	(75)
Northeast	0.9x	0.77	x	4.08	x	91.35	x	0.45	x	0.7	=	81.36	(75)
Northeast	0.9x	0.77	x	1.44	x	97.38	x	0.45	x	0.7	=	30.61	(75)
Northeast	0.9x	0.77	x	4.08	x	97.38	x	0.45	x	0.7	=	86.73	(75)
Northeast	0.9x	0.77	x	1.44	x	91.1	x	0.45	x	0.7	=	28.64	(75)
Northeast	0.9x	0.77	x	4.08	x	91.1	x	0.45	x	0.7	=	81.14	(75)
Northeast	0.9x	0.77	x	1.44	x	72.63	x	0.45	x	0.7	=	22.83	(75)
Northeast	0.9x	0.77	x	4.08	x	72.63	x	0.45	x	0.7	=	64.68	(75)
Northeast	0.9x	0.77	x	1.44	x	50.42	x	0.45	x	0.7	=	15.85	(75)
Northeast	0.9x	0.77	x	4.08	x	50.42	x	0.45	x	0.7	=	44.91	(75)
Northeast	0.9x	0.77	x	1.44	x	28.07	x	0.45	x	0.7	=	8.82	(75)
Northeast	0.9x	0.77	x	4.08	x	28.07	x	0.45	x	0.7	=	25	(75)
Northeast	0.9x	0.77	x	1.44	x	14.2	x	0.45	x	0.7	=	4.46	(75)
Northeast	0.9x	0.77	x	4.08	x	14.2	x	0.45	x	0.7	=	12.64	(75)
Northeast	0.9x	0.77	x	1.44	x	9.21	x	0.45	x	0.7	=	2.9	(75)
Northeast	0.9x	0.77	x	4.08	x	9.21	x	0.45	x	0.7	=	8.21	(75)
Southeast	0.9x	0.77	x	3.24	x	36.79	x	0.45	x	0.7	=	26.02	(77)
Southeast	0.9x	0.77	x	6	x	36.79	x	0.45	x	0.7	=	48.19	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	3.24	x	62.67	x	0.45	x	0.7	=	44.33	(77)
Southeast	0.9x	0.77	x	6	x	62.67	x	0.45	x	0.7	=	82.09	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	3.24	x	85.75	x	0.45	x	0.7	=	60.65	(77)
Southeast	0.9x	0.77	x	6	x	85.75	x	0.45	x	0.7	=	112.32	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	3.24	x	106.25	x	0.45	x	0.7	=	75.15	(77)
Southeast	0.9x	0.77	x	6	x	106.25	x	0.45	x	0.7	=	139.17	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)

Southeast 0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast 0.9x	0.77	x	3.24	x	119.01	x	0.45	x	0.7	=	84.17	(77)
Southeast 0.9x	0.77	x	6	x	119.01	x	0.45	x	0.7	=	155.88	(77)
Southeast 0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast 0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast 0.9x	0.77	x	3.24	x	118.15	x	0.45	x	0.7	=	83.56	(77)
Southeast 0.9x	0.77	x	6	x	118.15	x	0.45	x	0.7	=	154.75	(77)
Southeast 0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast 0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast 0.9x	0.77	x	3.24	x	113.91	x	0.45	x	0.7	=	80.57	(77)
Southeast 0.9x	0.77	x	6	x	113.91	x	0.45	x	0.7	=	149.19	(77)
Southeast 0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast 0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast 0.9x	0.77	x	3.24	x	104.39	x	0.45	x	0.7	=	73.83	(77)
Southeast 0.9x	0.77	x	6	x	104.39	x	0.45	x	0.7	=	136.73	(77)
Southeast 0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast 0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast 0.9x	0.77	x	3.24	x	92.85	x	0.45	x	0.7	=	65.67	(77)
Southeast 0.9x	0.77	x	6	x	92.85	x	0.45	x	0.7	=	121.61	(77)
Southeast 0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast 0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast 0.9x	0.77	x	3.24	x	69.27	x	0.45	x	0.7	=	48.99	(77)
Southeast 0.9x	0.77	x	6	x	69.27	x	0.45	x	0.7	=	90.72	(77)
Southeast 0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast 0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast 0.9x	0.77	x	3.24	x	44.07	x	0.45	x	0.7	=	31.17	(77)
Southeast 0.9x	0.77	x	6	x	44.07	x	0.45	x	0.7	=	57.72	(77)
Southeast 0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast 0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast 0.9x	0.77	x	3.24	x	31.49	x	0.45	x	0.7	=	22.27	(77)
Southeast 0.9x	0.77	x	6	x	31.49	x	0.45	x	0.7	=	41.24	(77)
Southeast 0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast 0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southwest 0.9x	0.77	x	4.2	x	36.79		0.45	x	0.7	=	33.73	(79)
Southwest 0.9x	0.77	x	4.2	x	62.67		0.45	x	0.7	=	57.46	(79)
Southwest 0.9x	0.77	x	4.2	x	85.75		0.45	x	0.7	=	78.62	(79)
Southwest 0.9x	0.77	x	4.2	x	106.25		0.45	x	0.7	=	97.42	(79)
Southwest 0.9x	0.77	x	4.2	x	119.01		0.45	x	0.7	=	109.11	(79)
Southwest 0.9x	0.77	x	4.2	x	118.15		0.45	x	0.7	=	108.32	(79)
Southwest 0.9x	0.77	x	4.2	x	113.91		0.45	x	0.7	=	104.44	(79)
Southwest 0.9x	0.77	x	4.2	x	104.39		0.45	x	0.7	=	95.71	(79)

Southwest	0.9x	0.77	x	4.2	x	92.85		0.45	x	0.7	=	85.13	(79)
Southwest	0.9x	0.77	x	4.2	x	69.27		0.45	x	0.7	=	63.51	(79)
Southwest	0.9x	0.77	x	4.2	x	44.07		0.45	x	0.7	=	40.41	(79)
Southwest	0.9x	0.77	x	4.2	x	31.49		0.45	x	0.7	=	28.87	(79)

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

(83)m=	160.58	278.04	392.43	506.34	585.49	589.33	564.82	504.53	431.68	310.53	193.16	136.89	(83)

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

(84)m=	611.37	726.7	826.74	917.42	972.86	953.91	914.62	860.49	799.59	701.89	611.49	575.56	(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=	0.95	0.92	0.87	0.79	0.66	0.51	0.38	0.42	0.62	0.82	0.92	0.96	(86)

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

(87)m=	19.16	19.46	19.88	20.35	20.7	20.9	20.97	20.96	20.82	20.36	19.68	19.1	(87)

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

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.14	20.13	20.12	20.12	(88)

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

(89)m=	0.94	0.91	0.86	0.76	0.62	0.45	0.31	0.35	0.56	0.8	0.91	0.95	(89)

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

(90)m=	17.64	18.08	18.67	19.33	19.79	20.05	20.12	20.11	19.96	19.35	18.4	17.57	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	18.15	18.54	19.07	19.67	20.1	20.34	20.4	20.4	20.25	19.69	18.83	18.08	(92)

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

(93)m=	18.15	18.54	19.07	19.67	20.1	20.34	20.4	20.4	20.25	19.69	18.83	18.08	(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=	0.93	0.89	0.83	0.74	0.62	0.47	0.34	0.37	0.57	0.78	0.89	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	565.82	646.36	690.19	683.17	603.14	444.64	307.34	319.16	454.42	547.15	545.84	537.88	(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=	1197.23	1176.02	1080.49	911.68	708.51	476.62	316.11	331.07	513.93	767.03	995.87	1185.88	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	469.77	355.93	290.38	164.53	78.4	0	0	0	0	163.59	324.02	482.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2328.74 (98)

Space heating requirement in kWh/m²/year 26.09 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2328.74	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2794.48	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2166.28	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2599.54	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	53.94	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		202	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	202	(331)
Energy for lighting (calculated in Appendix L)		374.26	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5240.21	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	999.82	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	27.99	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1027.82	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)

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CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1027.82	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	104.84	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	194.24	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =			947.99	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			10.62	(384)
EI rating (section 14)				90.54	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block D - Mid Floor

Address : D, Block D, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	89.26	(1a)	x	2.5	(2a)	=	223.15	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	89.26	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			223.15	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Windows Type 2			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 3			4.2	x1/[1/(1.2)+ 0.04]		=	4.81			(27)
Windows Type 4			6	x1/[1/(1.2)+ 0.04]		=	6.87			(27)
Windows Type 5			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 6			4.08	x1/[1/(1.2)+ 0.04]		=	4.67			(27)
Windows Type 7			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Walls Type1	66	23.82	42.18	x	0.16	=	6.75			(29)
Walls Type2	38.9	1.91	36.99	x	0.15	=	5.56			(29)
Total area of elements, m²			104.9							(31)
Party wall			15.85	x	0	=	0			(32)
Party floor			89.26							(32a)
Party ceiling			89.26							(32b)

** 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) =	41.5	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	7673.98	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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 | 9.44 | (36)

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

Total fabric heat loss (33) + (36) = | 50.94 | (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=	21.8	21.54	21.28	19.99	19.74	18.45	18.45	18.19	18.96	19.74	20.25	20.77	(38)

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

(39)m=	72.74	72.48	72.22	70.93	70.67	69.39	69.39	69.13	69.9	70.67	71.19	71.7	

Average = Sum(39)1…12 /12= | 70.87 | (39)

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

(40)m=	0.81	0.81	0.81	0.79	0.79	0.78	0.78	0.77	0.78	0.79	0.8	0.8	

Average = Sum(40)1…12 /12= | 0.79 | (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 | 2.62 | (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 | 96.32 | (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	105.95	102.1	98.24	94.39	90.54	86.69	86.69	90.54	94.39	98.24	102.1	105.95	

Total = Sum(44)1…12 = | 1155.8 | (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=	157.12	137.42	141.8	123.63	118.62	102.36	94.85	108.85	110.15	128.36	140.12	152.16	

Total = Sum(45)1…12 = | 1515.44 | (45)

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

(46)m=	23.57	20.61	21.27	18.54	17.79	15.35	14.23	16.33	16.52	19.25	21.02	22.82	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (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) = | 110 | (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0.02 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 1.03 | (52)

Temperature factor from Table 2b | 0.6 | (53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.03	(54)
Enter (50) or (54) in (55)		1.03	(55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	212.4	187.34	197.08	177.12	173.9	155.86	150.13	164.12	163.64	183.64	193.61	207.44	(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=	212.4	187.34	197.08	177.12	173.9	155.86	150.13	164.12	163.64	183.64	193.61	207.44	

Output from water heater (annual)$_{1...12}$ — 2166.28 (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=	96.46	85.63	91.37	83.9	83.66	76.83	75.76	80.41	79.42	86.9	89.38	94.82	(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=	130.77	130.77	130.77	130.77	130.77	130.77	130.77	130.77	130.77	130.77	130.77	130.77	(66)

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

(67)m=	21.19	18.82	15.31	11.59	8.66	7.31	7.9	10.27	13.79	17.51	20.43	21.78	(67)

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

(68)m=	237.71	240.18	233.96	220.73	204.02	188.32	177.83	175.37	181.58	194.82	211.52	227.22	(68)

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

(69)m=	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	(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=	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	-104.62	(71)

Water heating gains (Table 5)

(72)m=	129.66	127.43	122.81	116.53	112.45	106.71	101.83	108.08	110.3	116.8	124.15	127.44	(72)

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

(73)m=	450.79	448.66	434.31	411.08	387.37	364.58	349.8	355.95	367.91	391.36	418.33	438.67	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	1.44	x	11.28	x	0.45	x	0.7	=	3.55	(75)
Northeast	0.9x	0.77	x	4.08	x	11.28	x	0.45	x	0.7	=	10.05	(75)
Northeast	0.9x	0.77	x	1.44	x	22.97	x	0.45	x	0.7	=	7.22	(75)
Northeast	0.9x	0.77	x	4.08	x	22.97	x	0.45	x	0.7	=	20.46	(75)
Northeast	0.9x	0.77	x	1.44	x	41.38	x	0.45	x	0.7	=	13.01	(75)
Northeast	0.9x	0.77	x	4.08	x	41.38	x	0.45	x	0.7	=	36.85	(75)
Northeast	0.9x	0.77	x	1.44	x	67.96	x	0.45	x	0.7	=	21.36	(75)
Northeast	0.9x	0.77	x	4.08	x	67.96	x	0.45	x	0.7	=	60.52	(75)
Northeast	0.9x	0.77	x	1.44	x	91.35	x	0.45	x	0.7	=	28.71	(75)
Northeast	0.9x	0.77	x	4.08	x	91.35	x	0.45	x	0.7	=	81.36	(75)
Northeast	0.9x	0.77	x	1.44	x	97.38	x	0.45	x	0.7	=	30.61	(75)
Northeast	0.9x	0.77	x	4.08	x	97.38	x	0.45	x	0.7	=	86.73	(75)
Northeast	0.9x	0.77	x	1.44	x	91.1	x	0.45	x	0.7	=	28.64	(75)
Northeast	0.9x	0.77	x	4.08	x	91.1	x	0.45	x	0.7	=	81.14	(75)
Northeast	0.9x	0.77	x	1.44	x	72.63	x	0.45	x	0.7	=	22.83	(75)
Northeast	0.9x	0.77	x	4.08	x	72.63	x	0.45	x	0.7	=	64.68	(75)
Northeast	0.9x	0.77	x	1.44	x	50.42	x	0.45	x	0.7	=	15.85	(75)
Northeast	0.9x	0.77	x	4.08	x	50.42	x	0.45	x	0.7	=	44.91	(75)
Northeast	0.9x	0.77	x	1.44	x	28.07	x	0.45	x	0.7	=	8.82	(75)
Northeast	0.9x	0.77	x	4.08	x	28.07	x	0.45	x	0.7	=	25	(75)
Northeast	0.9x	0.77	x	1.44	x	14.2	x	0.45	x	0.7	=	4.46	(75)
Northeast	0.9x	0.77	x	4.08	x	14.2	x	0.45	x	0.7	=	12.64	(75)
Northeast	0.9x	0.77	x	1.44	x	9.21	x	0.45	x	0.7	=	2.9	(75)
Northeast	0.9x	0.77	x	4.08	x	9.21	x	0.45	x	0.7	=	8.21	(75)
Southeast	0.9x	0.77	x	3.24	x	36.79	x	0.45	x	0.7	=	26.02	(77)
Southeast	0.9x	0.77	x	6	x	36.79	x	0.45	x	0.7	=	48.19	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	3.24	x	62.67	x	0.45	x	0.7	=	44.33	(77)
Southeast	0.9x	0.77	x	6	x	62.67	x	0.45	x	0.7	=	82.09	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	3.24	x	85.75	x	0.45	x	0.7	=	60.65	(77)
Southeast	0.9x	0.77	x	6	x	85.75	x	0.45	x	0.7	=	112.32	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	3.24	x	106.25	x	0.45	x	0.7	=	75.15	(77)
Southeast	0.9x	0.77	x	6	x	106.25	x	0.45	x	0.7	=	139.17	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)

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Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	3.24	x	119.01	x	0.45	x	0.7	=	84.17	(77)
Southeast	0.9x	0.77	x	6	x	119.01	x	0.45	x	0.7	=	155.88	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	3.24	x	118.15	x	0.45	x	0.7	=	83.56	(77)
Southeast	0.9x	0.77	x	6	x	118.15	x	0.45	x	0.7	=	154.75	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	3.24	x	113.91	x	0.45	x	0.7	=	80.57	(77)
Southeast	0.9x	0.77	x	6	x	113.91	x	0.45	x	0.7	=	149.19	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	3.24	x	104.39	x	0.45	x	0.7	=	73.83	(77)
Southeast	0.9x	0.77	x	6	x	104.39	x	0.45	x	0.7	=	136.73	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	3.24	x	92.85	x	0.45	x	0.7	=	65.67	(77)
Southeast	0.9x	0.77	x	6	x	92.85	x	0.45	x	0.7	=	121.61	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	3.24	x	69.27	x	0.45	x	0.7	=	48.99	(77)
Southeast	0.9x	0.77	x	6	x	69.27	x	0.45	x	0.7	=	90.72	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	3.24	x	44.07	x	0.45	x	0.7	=	31.17	(77)
Southeast	0.9x	0.77	x	6	x	44.07	x	0.45	x	0.7	=	57.72	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	3.24	x	31.49	x	0.45	x	0.7	=	22.27	(77)
Southeast	0.9x	0.77	x	6	x	31.49	x	0.45	x	0.7	=	41.24	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southwest	0.9x	0.77	x	4.2	x	36.79		0.45	x	0.7	=	33.73	(79)
Southwest	0.9x	0.77	x	4.2	x	62.67		0.45	x	0.7	=	57.46	(79)
Southwest	0.9x	0.77	x	4.2	x	85.75		0.45	x	0.7	=	78.62	(79)
Southwest	0.9x	0.77	x	4.2	x	106.25		0.45	x	0.7	=	97.42	(79)
Southwest	0.9x	0.77	x	4.2	x	119.01		0.45	x	0.7	=	109.11	(79)
Southwest	0.9x	0.77	x	4.2	x	118.15		0.45	x	0.7	=	108.32	(79)
Southwest	0.9x	0.77	x	4.2	x	113.91		0.45	x	0.7	=	104.44	(79)
Southwest	0.9x	0.77	x	4.2	x	104.39		0.45	x	0.7	=	95.71	(79)

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Southwest	0.9x	0.77	x	4.2	x	92.85	0.45	x	0.7	=	85.13	(79)
Southwest	0.9x	0.77	x	4.2	x	69.27	0.45	x	0.7	=	63.51	(79)
Southwest	0.9x	0.77	x	4.2	x	44.07	0.45	x	0.7	=	40.41	(79)
Southwest	0.9x	0.77	x	4.2	x	31.49	0.45	x	0.7	=	28.87	(79)

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

(83)m=	160.58	278.04	392.43	506.34	585.49	589.33	564.82	504.53	431.68	310.53	193.16	136.89	(83)

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

(84)m=	611.37	726.7	826.74	917.42	972.86	953.91	914.62	860.49	799.59	701.89	611.49	575.56	(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=	0.94	0.91	0.85	0.74	0.6	0.45	0.33	0.36	0.55	0.79	0.91	0.95	(86)

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

(87)m=	19.56	19.85	20.21	20.6	20.84	20.96	20.99	20.98	20.91	20.58	20.02	19.51	(87)

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

(88)m=	20.24	20.24	20.25	20.26	20.26	20.27	20.27	20.28	20.27	20.26	20.26	20.25	(88)

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

(89)m=	0.94	0.9	0.83	0.72	0.57	0.4	0.28	0.31	0.51	0.76	0.9	0.95	(89)

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

(90)m=	18.3	18.72	19.23	19.76	20.08	20.23	20.26	20.26	20.18	19.76	18.97	18.23	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	18.72	19.1	19.56	20.04	20.33	20.48	20.51	20.5	20.42	20.03	19.32	18.66	(92)

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

(93)m=	18.72	19.1	19.56	20.04	20.33	20.48	20.51	20.5	20.42	20.03	19.32	18.66	(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=	0.92	0.88	0.81	0.71	0.57	0.41	0.29	0.32	0.52	0.75	0.88	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	562.94	638.62	673.47	650.27	555.02	394.2	267.97	279.31	412.93	525.98	539.44	535.8	(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=	1048.76	1028.93	943.22	790.34	610.26	407.69	271.1	283.76	442.02	666.75	869.73	1036.75	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	361.45	262.29	200.69	100.85	41.1	0	0	0	0	104.73	237.82	372.71	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1681.63 (98)

Space heating requirement in kWh/m²/year 18.84 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1681.63	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2017.95	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2166.28	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2599.54	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	46.17	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		202	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	202	(331)
Energy for lighting (calculated in Appendix L)		374.26	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4463.68	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	855.89	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	23.96	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	879.85	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)

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CO_2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO_2 associated with space and water heating	(373) + (374) + (375) =			879.85	(376)
CO_2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	104.84	(378)
CO_2 associated with electricity for lighting	(332))) x	0.52	=	194.24	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-378.91	(380)
Total CO_2, kg/year	sum of (376)…(382) =			800.02	(383)
Dwelling CO_2 Emission Rate	(383) ÷ (4) =			8.96	(384)
EI rating (section 14)				92.02	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block E - Ground Floor

Address : E, Block E, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.48	(1a) x	2.5	(2a) =	126.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.48	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	126.2	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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 *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*		0	(11)
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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			5.4	x1/[1/(1.2)+ 0.04]		=	6.18			(27)
Windows Type 2			3.6	x1/[1/(1.2)+ 0.04]		=	4.12			(27)
Windows Type 3			3.36	x1/[1/(1.2)+ 0.04]		=	3.85			(27)
Floor			50.48	x	0.1	=	5.048			(28)
Walls Type1	25.92	12.36	13.56	x	0.16	=	2.17			(29)
Walls Type2	38.15	1.91	36.24	x	0.15	=	5.45			(29)
Total area of elements, m²			114.56							(31)
Party wall			12.32	x	0	=	0			(32)
Party ceiling			50.48							(32b)

** 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) = 28.73 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8070.07 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 8.73 (36)

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

Total fabric heat loss (33) + (36) = 37.46 (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=	12.33	12.18	12.04	11.31	11.16	10.43	10.43	10.29	10.72	11.16	11.45	11.74	(38)

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

(39)m=	49.78	49.64	49.49	48.76	48.62	47.89	47.89	47.74	48.18	48.62	48.91	49.2	

Average = Sum(39)$_{1...12}$ /12= 48.73 (39)

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

(40)m=	0.99	0.98	0.98	0.97	0.96	0.95	0.95	0.95	0.95	0.96	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.97 (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 1.7 (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 74.68 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.14	79.16	76.17	73.18	70.2	67.21	67.21	70.2	73.18	76.17	79.16	82.14	

Total = Sum(44)$_{1...12}$ = 896.11 (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=	121.82	106.54	109.94	95.85	91.97	79.36	73.54	84.39	85.4	99.52	108.64	117.97	

Total = Sum(45)$_{1...12}$ = 1174.94 (45)

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

(46)m=	18.27	15.98	16.49	14.38	13.8	11.9	11.03	12.66	12.81	14.93	16.3	17.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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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=	177.09	156.47	165.22	149.34	147.25	132.86	128.82	139.67	138.89	154.8	162.13	173.25	(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=	177.09	156.47	165.22	149.34	147.25	132.86	128.82	139.67	138.89	154.8	162.13	173.25

Output from water heater (annual)$_{1…12}$	1825.78	(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=	84.73	75.37	80.78	74.66	74.8	69.18	68.67	72.28	71.19	77.31	78.92	83.45	(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=	85.21	85.21	85.21	85.21	85.21	85.21	85.21	85.21	85.21	85.21	85.21	85.21	(66)

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

(67)m=	13.24	11.76	9.56	7.24	5.41	4.57	4.94	6.42	8.61	10.93	12.76	13.61	(67)

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

(68)m=	148.48	150.02	146.14	137.87	127.44	117.63	111.08	109.54	113.42	121.69	132.12	141.93	(68)

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

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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=	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	(71)

Water heating gains (Table 5)

(72)m=	113.88	112.15	108.57	103.7	100.54	96.09	92.3	97.15	98.87	103.91	109.61	112.16	(72)

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

(73)m=	324.16	322.5	312.83	297.38	281.95	266.85	256.88	261.67	269.47	285.1	303.05	316.26	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	3.36	x	11.28	x	0.45	x	0.7	=	8.28	(75)
Northeast	0.9x	0.77	x	3.36	x	22.97	x	0.45	x	0.7	=	16.85	(75)

Northeast 0.9x	0.77	x	3.36	x	41.38	x	0.45	x	0.7	=	30.35	(75)
Northeast 0.9x	0.77	x	3.36	x	67.96	x	0.45	x	0.7	=	49.84	(75)
Northeast 0.9x	0.77	x	3.36	x	91.35	x	0.45	x	0.7	=	67	(75)
Northeast 0.9x	0.77	x	3.36	x	97.38	x	0.45	x	0.7	=	71.43	(75)
Northeast 0.9x	0.77	x	3.36	x	91.1	x	0.45	x	0.7	=	66.82	(75)
Northeast 0.9x	0.77	x	3.36	x	72.63	x	0.45	x	0.7	=	53.27	(75)
Northeast 0.9x	0.77	x	3.36	x	50.42	x	0.45	x	0.7	=	36.98	(75)
Northeast 0.9x	0.77	x	3.36	x	28.07	x	0.45	x	0.7	=	20.59	(75)
Northeast 0.9x	0.77	x	3.36	x	14.2	x	0.45	x	0.7	=	10.41	(75)
Northeast 0.9x	0.77	x	3.36	x	9.21	x	0.45	x	0.7	=	6.76	(75)
Southeast 0.9x	0.77	x	5.4	x	36.79	x	0.45	x	0.7	=	43.37	(77)
Southeast 0.9x	0.77	x	3.6	x	36.79	x	0.45	x	0.7	=	28.91	(77)
Southeast 0.9x	0.77	x	5.4	x	62.67	x	0.45	x	0.7	=	73.88	(77)
Southeast 0.9x	0.77	x	3.6	x	62.67	x	0.45	x	0.7	=	49.25	(77)
Southeast 0.9x	0.77	x	5.4	x	85.75	x	0.45	x	0.7	=	101.08	(77)
Southeast 0.9x	0.77	x	3.6	x	85.75	x	0.45	x	0.7	=	67.39	(77)
Southeast 0.9x	0.77	x	5.4	x	106.25	x	0.45	x	0.7	=	125.25	(77)
Southeast 0.9x	0.77	x	3.6	x	106.25	x	0.45	x	0.7	=	83.5	(77)
Southeast 0.9x	0.77	x	5.4	x	119.01	x	0.45	x	0.7	=	140.29	(77)
Southeast 0.9x	0.77	x	3.6	x	119.01	x	0.45	x	0.7	=	93.53	(77)
Southeast 0.9x	0.77	x	5.4	x	118.15	x	0.45	x	0.7	=	139.27	(77)
Southeast 0.9x	0.77	x	3.6	x	118.15	x	0.45	x	0.7	=	92.85	(77)
Southeast 0.9x	0.77	x	5.4	x	113.91	x	0.45	x	0.7	=	134.28	(77)
Southeast 0.9x	0.77	x	3.6	x	113.91	x	0.45	x	0.7	=	89.52	(77)
Southeast 0.9x	0.77	x	5.4	x	104.39	x	0.45	x	0.7	=	123.05	(77)
Southeast 0.9x	0.77	x	3.6	x	104.39	x	0.45	x	0.7	=	82.04	(77)
Southeast 0.9x	0.77	x	5.4	x	92.85	x	0.45	x	0.7	=	109.45	(77)
Southeast 0.9x	0.77	x	3.6	x	92.85	x	0.45	x	0.7	=	72.97	(77)
Southeast 0.9x	0.77	x	5.4	x	69.27	x	0.45	x	0.7	=	81.65	(77)
Southeast 0.9x	0.77	x	3.6	x	69.27	x	0.45	x	0.7	=	54.43	(77)
Southeast 0.9x	0.77	x	5.4	x	44.07	x	0.45	x	0.7	=	51.95	(77)
Southeast 0.9x	0.77	x	3.6	x	44.07	x	0.45	x	0.7	=	34.63	(77)
Southeast 0.9x	0.77	x	5.4	x	31.49	x	0.45	x	0.7	=	37.12	(77)
Southeast 0.9x	0.77	x	3.6	x	31.49	x	0.45	x	0.7	=	24.75	(77)

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

(83)m=	80.56	139.98	198.82	258.59	300.81	303.55	290.61	258.36	219.4	156.67	97	68.62	(83)

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

(84)m=	404.72	462.47	511.66	555.97	582.77	570.4	547.5	520.03	488.88	441.78	400.05	384.88	(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

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(86)m=	0.93	0.9	0.85	0.77	0.64	0.49	0.37	0.4	0.59	0.79	0.9	0.94	(86)

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

(87)m=	19.29	19.56	19.94	20.38	20.71	20.91	20.97	20.96	20.83	20.41	19.79	19.25	(87)

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

(88)m=	20.09	20.1	20.1	20.11	20.11	20.13	20.13	20.13	20.12	20.11	20.11	20.1	(88)

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

(89)m=	0.92	0.89	0.83	0.74	0.6	0.44	0.3	0.33	0.53	0.76	0.89	0.93	(89)

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

(90)m=	17.83	18.21	18.74	19.36	19.79	20.04	20.11	20.1	19.96	19.42	18.55	17.76	(90)

fLA = Living area ÷ (4) = 0.48 (91)

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

(92)m=	18.54	18.86	19.32	19.85	20.24	20.46	20.52	20.52	20.38	19.9	19.15	18.48	(92)

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

(93)m=	18.54	18.86	19.32	19.85	20.24	20.46	20.52	20.52	20.38	19.9	19.15	18.48	(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=	0.9	0.87	0.82	0.73	0.61	0.46	0.33	0.36	0.55	0.75	0.87	0.91	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	365.65	401.98	417.85	405.61	354.86	261.89	182.58	189.53	269.51	332.91	346.74	351.28	(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=	708.71	693.15	634.64	534.07	415.06	280.57	187.91	196.56	302.68	452.04	589.35	702.61	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	255.23	195.67	161.3	92.49	44.79	0	0	0	0	88.63	174.67	261.39	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1274.17 (98)

Space heating requirement in kWh/m²/year 25.24 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump	1	(303a)
Fraction of total space heat from Community heat pump (302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	1.2	(306)

Space heating	**kWh/year**
Annual space heating requirement	1274.17

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1529	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1825.78	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2190.94	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	37.2	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		114.24	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	114.24	(331)
Energy for lighting (calculated in Appendix L)		233.77	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3337.88	(338)

12b. CO_2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	928.2	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.31	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	947.5	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				947.5	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	59.29	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	121.33	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				749.21	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.84	(384)
EI rating (section 14)					89.49	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block E - Mid Floor

Address : E, Block E, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.48	(1a) x	2.5	(2a) =	126.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.48	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	126.2	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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 *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*		0	(11)
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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			5.4		x1/[1/(1.2)+ 0.04]	=	6.18			(27)
Windows Type 2			3.6		x1/[1/(1.2)+ 0.04]	=	4.12			(27)
Windows Type 3			3.36		x1/[1/(1.2)+ 0.04]	=	3.85			(27)
Walls Type1	25.92	12.36	13.56	x	0.16	=	2.17			(29)
Walls Type2	38.15	1.91	36.24	x	0.15	=	5.45			(29)
Total area of elements, m²			64.08							(31)
Party wall			12.32	x	0	=	0			(32)
Party floor			50.48							(32a)
Party ceiling			50.48							(32b)

** 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) =	23.68	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	4536.47	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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		5.64	(36)

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

Total fabric heat loss	(33) + (36) =	29.32	(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

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	12.33	12.18	12.04	11.31	11.16	10.43	10.43	10.29	10.72	11.16	11.45	11.74		(38)

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

(39)m=	41.65	41.5	41.35	40.63	40.48	39.75	39.75	39.61	40.04	40.48	40.77	41.06		
										Average = Sum(39)$_{1...12}$ /12=			40.59	(39)

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

(40)m=	0.82	0.82	0.82	0.8	0.8	0.79	0.79	0.78	0.79	0.8	0.81	0.81		
										Average = Sum(40)$_{1...12}$ /12=			0.8	(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 1.7 (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 74.68 (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=	82.14	79.16	76.17	73.18	70.2	67.21	67.21	70.2	73.18	76.17	79.16	82.14		
										Total = Sum(44)$_{1...12}$ =			896.11	(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=	121.82	106.54	109.94	95.85	91.97	79.36	73.54	84.39	85.4	99.52	108.64	117.97		
										Total = Sum(45)$_{1...12}$ =			1174.94	(45)

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

(46)m=	18.27	15.98	16.49	14.38	13.8	11.9	11.03	12.66	12.81	14.93	16.3	17.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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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=	177.09	156.47	165.22	149.34	147.25	132.86	128.82	139.67	138.89	154.8	162.13	173.25	(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=	177.09	156.47	165.22	149.34	147.25	132.86	128.82	139.67	138.89	154.8	162.13	173.25

Output from water heater (annual)$_{1...12}$	1825.78	(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=	84.73	75.37	80.78	74.66	74.8	69.18	68.67	72.28	71.19	77.31	78.92	83.45	(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=	85.21	85.21	85.21	85.21	85.21	85.21	85.21	85.21	85.21	85.21	85.21	85.21	(66)

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

(67)m=	13.24	11.76	9.56	7.24	5.41	4.57	4.94	6.42	8.61	10.93	12.76	13.61	(67)

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

(68)m=	148.48	150.02	146.14	137.87	127.44	117.63	111.08	109.54	113.42	121.69	132.12	141.93	(68)

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

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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=	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	-68.17	(71)

Water heating gains (Table 5)

(72)m=	113.88	112.15	108.57	103.7	100.54	96.09	92.3	97.15	98.87	103.91	109.61	112.16	(72)

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

(73)m=	324.16	322.5	312.83	297.38	281.95	266.85	256.88	261.67	269.47	285.1	303.05	316.26	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.36	x	11.28	x	0.45	x	0.7	=	8.28	(75)
Northeast 0.9x	0.77	x	3.36	x	22.97	x	0.45	x	0.7	=	16.85	(75)

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Northeast 0.9x	0.77	x	3.36	x	41.38	x	0.45	x	0.7	=	30.35	(75)
Northeast 0.9x	0.77	x	3.36	x	67.96	x	0.45	x	0.7	=	49.84	(75)
Northeast 0.9x	0.77	x	3.36	x	91.35	x	0.45	x	0.7	=	67	(75)
Northeast 0.9x	0.77	x	3.36	x	97.38	x	0.45	x	0.7	=	71.43	(75)
Northeast 0.9x	0.77	x	3.36	x	91.1	x	0.45	x	0.7	=	66.82	(75)
Northeast 0.9x	0.77	x	3.36	x	72.63	x	0.45	x	0.7	=	53.27	(75)
Northeast 0.9x	0.77	x	3.36	x	50.42	x	0.45	x	0.7	=	36.98	(75)
Northeast 0.9x	0.77	x	3.36	x	28.07	x	0.45	x	0.7	=	20.59	(75)
Northeast 0.9x	0.77	x	3.36	x	14.2	x	0.45	x	0.7	=	10.41	(75)
Northeast 0.9x	0.77	x	3.36	x	9.21	x	0.45	x	0.7	=	6.76	(75)
Southeast 0.9x	0.77	x	5.4	x	36.79	x	0.45	x	0.7	=	43.37	(77)
Southeast 0.9x	0.77	x	3.6	x	36.79	x	0.45	x	0.7	=	28.91	(77)
Southeast 0.9x	0.77	x	5.4	x	62.67	x	0.45	x	0.7	=	73.88	(77)
Southeast 0.9x	0.77	x	3.6	x	62.67	x	0.45	x	0.7	=	49.25	(77)
Southeast 0.9x	0.77	x	5.4	x	85.75	x	0.45	x	0.7	=	101.08	(77)
Southeast 0.9x	0.77	x	3.6	x	85.75	x	0.45	x	0.7	=	67.39	(77)
Southeast 0.9x	0.77	x	5.4	x	106.25	x	0.45	x	0.7	=	125.25	(77)
Southeast 0.9x	0.77	x	3.6	x	106.25	x	0.45	x	0.7	=	83.5	(77)
Southeast 0.9x	0.77	x	5.4	x	119.01	x	0.45	x	0.7	=	140.29	(77)
Southeast 0.9x	0.77	x	3.6	x	119.01	x	0.45	x	0.7	=	93.53	(77)
Southeast 0.9x	0.77	x	5.4	x	118.15	x	0.45	x	0.7	=	139.27	(77)
Southeast 0.9x	0.77	x	3.6	x	118.15	x	0.45	x	0.7	=	92.85	(77)
Southeast 0.9x	0.77	x	5.4	x	113.91	x	0.45	x	0.7	=	134.28	(77)
Southeast 0.9x	0.77	x	3.6	x	113.91	x	0.45	x	0.7	=	89.52	(77)
Southeast 0.9x	0.77	x	5.4	x	104.39	x	0.45	x	0.7	=	123.05	(77)
Southeast 0.9x	0.77	x	3.6	x	104.39	x	0.45	x	0.7	=	82.04	(77)
Southeast 0.9x	0.77	x	5.4	x	92.85	x	0.45	x	0.7	=	109.45	(77)
Southeast 0.9x	0.77	x	3.6	x	92.85	x	0.45	x	0.7	=	72.97	(77)
Southeast 0.9x	0.77	x	5.4	x	69.27	x	0.45	x	0.7	=	81.65	(77)
Southeast 0.9x	0.77	x	3.6	x	69.27	x	0.45	x	0.7	=	54.43	(77)
Southeast 0.9x	0.77	x	5.4	x	44.07	x	0.45	x	0.7	=	51.95	(77)
Southeast 0.9x	0.77	x	3.6	x	44.07	x	0.45	x	0.7	=	34.63	(77)
Southeast 0.9x	0.77	x	5.4	x	31.49	x	0.45	x	0.7	=	37.12	(77)
Southeast 0.9x	0.77	x	3.6	x	31.49	x	0.45	x	0.7	=	24.75	(77)

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

(83)m=	80.56	139.98	198.82	258.59	300.81	303.55	290.61	258.36	219.4	156.67	97	68.62	(83)

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

(84)m=	404.72	462.47	511.66	555.97	582.77	570.4	547.5	520.03	488.88	441.78	400.05	384.88	(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

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(86)m=	0.92	0.88	0.82	0.72	0.58	0.43	0.31	0.34	0.53	0.75	0.88	0.93	(86)

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

(87)m=	19.71	19.96	20.28	20.63	20.85	20.96	20.99	20.99	20.92	20.64	20.14	19.67	(87)

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

(88)m=	20.23	20.23	20.24	20.25	20.25	20.26	20.26	20.27	20.26	20.25	20.25	20.24	(88)

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

(89)m=	0.91	0.87	0.8	0.69	0.55	0.38	0.26	0.29	0.48	0.72	0.86	0.92	(89)

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

(90)m=	18.51	18.86	19.32	19.8	20.09	20.23	20.26	20.26	20.18	19.82	19.13	18.46	(90)

fLA = Living area ÷ (4) = 0.48 (91)

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

(92)m=	19.09	19.4	19.79	20.2	20.46	20.58	20.61	20.61	20.54	20.22	19.62	19.04	(92)

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

(93)m=	19.09	19.4	19.79	20.2	20.46	20.58	20.61	20.61	20.54	20.22	19.62	19.04	(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=	0.89	0.85	0.79	0.69	0.56	0.4	0.29	0.32	0.5	0.72	0.85	0.9	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	362.01	394.93	405.11	383.3	324.1	230.25	157.63	164.21	242.45	316.84	340.24	348.3	(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=	615.95	601.56	549.41	459.06	354.45	237.8	159.45	166.7	257.84	389.24	510.32	609.46	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	188.93	138.86	107.36	54.55	22.58	0	0	0	0	53.87	122.46	194.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 882.9 (98)

Space heating requirement in kWh/m²/year 17.49 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump	1	(303a)
Fraction of total space heat from Community heat pump (302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	1.2	(306)

Space heating **kWh/year**

Annual space heating requirement 882.9

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1059.48	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1825.78	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2190.94	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	32.5	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		114.24	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	114.24	(331)
Energy for lighting (calculated in Appendix L)		233.77	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		2868.36	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	811.04	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	16.87	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	827.91	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				827.91	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	59.29	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	121.33	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =		-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				629.62	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				12.47	(384)
EI rating (section 14)					91.16	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block E - Top Floor

Address : E, Block E, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.5	(1a) x	2.5	(2a) =	131.25	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	131.25	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

	0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			6		x1/[1/(1.2)+ 0.04]	=	6.87			(27)
Windows Type 2			2.43		x1/[1/(1.2)+ 0.04]	=	2.78			(27)
Windows Type 3			2.43		x1/[1/(1.2)+ 0.04]	=	2.78			(27)
Windows Type 4			2.43		x1/[1/(1.2)+ 0.04]	=	2.78			(27)
Walls Type1	47.5	13.29	34.21	x	0.16	=	5.47			(29)
Walls Type2	8	1.91	6.09	x	0.15	=	0.92			(29)
Roof	52.5	0	52.5	x	0.1	=	5.25			(30)
Total area of elements, m²			108							(31)
Party wall			34.28	x	0	=	0			(32)
Party floor			52.5							(32a)

** 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) = 28.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4477.58 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 16.93 (36)

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

Total fabric heat loss (33) + (36) = 45.7 (37)

DER WorkSheet: New dwelling design stage

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=	12.82	12.67	12.52	11.76	11.61	10.85	10.85	10.7	11.15	11.61	11.91	12.21	(38)

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

(39)m=	58.52	58.37	58.22	57.46	57.31	56.55	56.55	56.4	56.85	57.31	57.61	57.91	

Average = Sum(39)$_{1\ldots12}$ /12= 57.42 (39)

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

(40)m=	1.11	1.11	1.11	1.09	1.09	1.08	1.08	1.07	1.08	1.09	1.1	1.1	

Average = Sum(40)$_{1\ldots12}$ /12= 1.09 (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 1.76 (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 76.09 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	83.7	80.66	77.61	74.57	71.53	68.48	68.48	71.53	74.57	77.61	80.66	83.7	

Total = Sum(44)$_{1\ldots12}$ = 913.09 (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=	124.12	108.56	112.02	97.67	93.71	80.87	74.93	85.99	87.02	101.41	110.7	120.21	

Total = Sum(45)$_{1\ldots12}$ = 1197.2 (45)

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

(46)m=	18.62	16.28	16.8	14.65	14.06	12.13	11.24	12.9	13.05	15.21	16.6	18.03	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	179.4	158.49	167.3	151.16	148.99	134.36	130.21	141.27	140.51	156.69	164.19	175.48	(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=	179.4	158.49	167.3	151.16	148.99	134.36	130.21	141.27	140.51	156.69	164.19	175.48

Output from water heater (annual)$_{1…12}$ — 1848.04 (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=	85.49	76.04	81.47	75.27	75.38	69.68	69.14	72.81	71.73	77.94	79.6	84.19	(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=	88.19	88.19	88.19	88.19	88.19	88.19	88.19	88.19	88.19	88.19	88.19	88.19	(66)

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

(67)m=	13.7	12.17	9.9	7.49	5.6	4.73	5.11	6.64	8.92	11.32	13.21	14.09	(67)

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

(68)m=	153.72	155.32	151.3	142.74	131.94	121.79	115	113.41	117.43	125.98	136.79	146.94	(68)

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

(69)m=	31.82	31.82	31.82	31.82	31.82	31.82	31.82	31.82	31.82	31.82	31.82	31.82	(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=	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	(71)

Water heating gains (Table 5)

(72)m=	114.91	113.15	109.5	104.54	101.32	96.78	92.93	97.87	99.62	104.76	110.56	113.16	(72)

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

(73)m=	331.79	330.1	320.16	304.23	288.32	272.75	262.5	267.37	275.42	291.52	310.01	323.64	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	6	x	11.28	x	0.45	x	0.7	=	14.78	(75)
Northeast	0.9x	0.77	x	6	x	22.97	x	0.45	x	0.7	=	30.08	(75)
Northeast	0.9x	0.77	x	6	x	41.38	x	0.45	x	0.7	=	54.2	(75)
Northeast	0.9x	0.77	x	6	x	67.96	x	0.45	x	0.7	=	89.01	(75)
Northeast	0.9x	0.77	x	6	x	91.35	x	0.45	x	0.7	=	119.64	(75)
Northeast	0.9x	0.77	x	6	x	97.38	x	0.45	x	0.7	=	127.55	(75)
Northeast	0.9x	0.77	x	6	x	91.1	x	0.45	x	0.7	=	119.32	(75)
Northeast	0.9x	0.77	x	6	x	72.63	x	0.45	x	0.7	=	95.12	(75)
Northeast	0.9x	0.77	x	6	x	50.42	x	0.45	x	0.7	=	66.04	(75)
Northeast	0.9x	0.77	x	6	x	28.07	x	0.45	x	0.7	=	36.76	(75)
Northeast	0.9x	0.77	x	6	x	14.2	x	0.45	x	0.7	=	18.59	(75)
Northeast	0.9x	0.77	x	6	x	9.21	x	0.45	x	0.7	=	12.07	(75)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)

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Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)

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

(83)m=	73.33	129.82	190.66	258.09	309.03	315.57	300.59	261.25	213.8	146.99	88.73	62.18	(83)

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

(84)m=	405.12	459.92	510.82	562.32	597.35	588.33	563.09	528.62	489.22	438.51	398.74	385.82	(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=	0.94	0.92	0.88	0.8	0.69	0.54	0.41	0.45	0.65	0.83	0.92	0.95	(86)

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

(87)m=	18.95	19.22	19.63	20.15	20.57	20.84	20.94	20.93	20.73	20.19	19.49	18.9	(87)

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

(88)m=	19.99	19.99	19.99	20.01	20.01	20.02	20.02	20.02	20.01	20.01	20	20	(88)

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

(89)m=	0.93	0.91	0.86	0.77	0.64	0.47	0.33	0.37	0.58	0.8	0.9	0.94	(89)

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

(90)m=	17.26	17.65	18.24	18.97	19.54	19.88	19.98	19.97	19.76	19.05	18.06	17.2	(90)

fLA = Living area ÷ (4) = 0.52 (91)

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

(92)m=	18.15	18.47	18.97	19.59	20.08	20.39	20.49	20.47	20.27	19.65	18.81	18.09	(92)

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

(93)m=	18.15	18.47	18.97	19.59	20.08	20.39	20.49	20.47	20.27	19.65	18.81	18.09	(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=	0.91	0.89	0.84	0.76	0.65	0.5	0.37	0.41	0.6	0.79	0.88	0.92	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	370.36	407.48	429.11	427.63	385.83	293.96	209.1	215.67	293.88	345.27	352.38	355.76	(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=	810.24	792.01	726.05	614.22	480.26	327.15	219.8	229.72	350.68	518.55	674.53	804.44	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	327.28	258.41	220.92	134.34	70.25	0	0	0	0	128.92	231.95	333.82	(98)

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1705.89	(98)
Space heating requirement in kWh/m²/year		32.49	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1705.89	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2047.06	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1848.04	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2217.65	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.65	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		100.08	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	100.08	(331)
Energy for lighting (calculated in Appendix L)		242.03	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3876.74	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1064.13	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.13	(372)

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1086.26	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1086.26	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	51.94	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	125.61	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =			884.91	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.86	(384)
EI rating (section 14)				87.84	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.49

Property Address: Block I - Ground Floor

Address : I, Block I, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.44	(1a) x	2.5	(2a) =	176.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.44	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.1	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 2			5.88	x1/[1/(1.2)+ 0.04]		=	6.73			(27)
Windows Type 3			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 4			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Floor			70.44	x	0.1	=	7.044			(28)
Walls Type1	34.17	13.17	21	x	0.16	=	3.36			(29)
Walls Type2	31.98	1.91	30.07	x	0.15	=	4.52			(29)
Total area of elements, m²			136.59							(31)
Party wall			21.75	x	0	=	0			(32)
Party ceiling			70.44							(32b)

** 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) = 31.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11299.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 10 (36)

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

Total fabric heat loss (33) + (36) = 41.91 (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=	17.2	17	16.79	15.78	15.57	14.56	14.56	14.35	14.96	15.57	15.98	16.39	(38)

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

(39)m=	59.12	58.91	58.71	57.69	57.49	56.47	56.47	56.27	56.88	57.49	57.9	58.3	

Average = $Sum(39)_{1...12}$ /12= 57.64 (39)

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

(40)m=	0.84	0.84	0.83	0.82	0.82	0.8	0.8	0.8	0.81	0.82	0.82	0.83	

Average = $Sum(40)_{1...12}$ /12= 0.82 (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 2.26 (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 87.8 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	96.58	93.07	89.55	86.04	82.53	79.02	79.02	82.53	86.04	89.55	93.07	96.58	

Total = $Sum(44)_{1...12}$ = 1053.58 (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=	143.22	125.26	129.26	112.69	108.13	93.31	86.46	99.22	100.4	117.01	127.73	138.7	

Total = $Sum(45)_{1...12}$ = 1381.41 (45)

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

(46)m=	21.48	18.79	19.39	16.9	16.22	14	12.97	14.88	15.06	17.55	19.16	20.81	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	198.5	175.19	184.54	166.19	163.41	146.8	141.74	154.5	153.9	172.29	181.22	193.98	(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=	198.5	175.19	184.54	166.19	163.41	146.8	141.74	154.5	153.9	172.29	181.22	193.98

Output from water heater (annual)$_{1...12}$ — 2032.24 (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=	91.84	81.59	87.2	80.27	80.17	73.82	72.97	77.21	76.18	83.13	85.26	90.34	(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=	112.84	112.84	112.84	112.84	112.84	112.84	112.84	112.84	112.84	112.84	112.84	112.84	(66)

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

(67)m=	17.95	15.95	12.97	9.82	7.34	6.2	6.7	8.7	11.68	14.83	17.31	18.45	(67)

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

(68)m=	198.32	200.38	195.19	184.15	170.22	157.12	148.37	146.31	151.5	162.54	176.47	189.57	(68)

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

(69)m=	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	(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=	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	(71)

Water heating gains (Table 5)

(72)m=	123.44	121.42	117.2	111.48	107.76	102.53	98.08	103.78	105.8	111.73	118.42	121.42	(72)

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

(73)m=	396.57	394.59	382.22	362.3	342.17	322.69	309.99	315.64	325.83	345.95	369.06	386.3	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	2.43	x	36.79		0.45	x	0.7	=	19.52	(79)
Southwest	0.9x	0.77	x	2.43	x	62.67		0.45	x	0.7	=	33.25	(79)
Southwest	0.9x	0.77	x	2.43	x	85.75		0.45	x	0.7	=	45.49	(79)
Southwest	0.9x	0.77	x	2.43	x	106.25		0.45	x	0.7	=	56.36	(79)
Southwest	0.9x	0.77	x	2.43	x	119.01		0.45	x	0.7	=	63.13	(79)
Southwest	0.9x	0.77	x	2.43	x	118.15		0.45	x	0.7	=	62.67	(79)
Southwest	0.9x	0.77	x	2.43	x	113.91		0.45	x	0.7	=	60.42	(79)
Southwest	0.9x	0.77	x	2.43	x	104.39		0.45	x	0.7	=	55.37	(79)
Southwest	0.9x	0.77	x	2.43	x	92.85		0.45	x	0.7	=	49.25	(79)
Southwest	0.9x	0.77	x	2.43	x	69.27		0.45	x	0.7	=	36.74	(79)
Southwest	0.9x	0.77	x	2.43	x	44.07		0.45	x	0.7	=	23.38	(79)
Southwest	0.9x	0.77	x	2.43	x	31.49		0.45	x	0.7	=	16.7	(79)
Northwest	0.9x	0.77	x	5.88	x	11.28	x	0.45	x	0.7	=	14.48	(81)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	5.88	x	22.97	x	0.45	x	0.7	=	29.48	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	5.88	x	41.38	x	0.45	x	0.7	=	53.11	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	5.88	x	67.96	x	0.45	x	0.7	=	87.23	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	5.88	x	91.35	x	0.45	x	0.7	=	117.25	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest	0.9x	0.77	x	5.88	x	97.38	x	0.45	x	0.7	=	125	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	5.88	x	91.1	x	0.45	x	0.7	=	116.94	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	5.88	x	72.63	x	0.45	x	0.7	=	93.22	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	5.88	x	50.42	x	0.45	x	0.7	=	64.72	(81)
Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	5.88	x	28.07	x	0.45	x	0.7	=	36.03	(81)
Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)

Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest	0.9x	0.77	x	5.88	x	14.2	x	0.45	x	0.7	=	18.22	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	5.88	x	9.21	x	0.45	x	0.7	=	11.83	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)

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

(83)m=	45.97	87.09	142.5	215.68	277.29	290.99	274.01	225.65	167.46	102.55	56.66	38.31	(83)

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

(84)m=	442.54	481.69	524.72	577.99	619.46	613.68	584	541.29	493.3	448.5	425.72	424.61	(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=	0.96	0.94	0.91	0.83	0.71	0.54	0.41	0.46	0.67	0.86	0.94	0.96	(86)

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

(87)m=	19.4	19.59	19.93	20.38	20.72	20.92	20.98	20.96	20.83	20.39	19.84	19.37	(87)

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

(88)m=	20.22	20.22	20.22	20.24	20.24	20.25	20.25	20.25	20.25	20.24	20.23	20.23	(88)

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

(89)m=	0.95	0.93	0.9	0.81	0.67	0.49	0.35	0.39	0.62	0.84	0.93	0.96	(89)

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

(90)m=	18.05	18.33	18.82	19.46	19.92	20.17	20.23	20.23	20.07	19.49	18.7	18.02	(90)

fLA = Living area ÷ (4) = 0.36 (91)

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

(92)m=	18.54	18.79	19.22	19.79	20.21	20.44	20.5	20.49	20.34	19.82	19.11	18.51	(92)

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

(93)m=	18.54	18.79	19.22	19.79	20.21	20.44	20.5	20.49	20.34	19.82	19.11	18.51	(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=	0.94	0.92	0.88	0.8	0.67	0.5	0.37	0.41	0.63	0.83	0.91	0.94	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	413.92	441.25	460.13	460.16	414.34	308.87	214.76	222.35	310.47	370.08	387.52	399.75	(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=	841.67	818.09	746.9	628.21	489.23	329.86	220.29	230.31	354.99	529.91	695.39	834.03	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	318.25	253.24	213.36	121	55.72	0	0	0	0	118.91	221.66	323.1	

DER WorkSheet: New dwelling design stage

	Total per year (kWh/year) = Sum(98)1...5,9...12 =	1625.24	(98)
Space heating requirement in kWh/m²/year		23.07	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1625.24	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1950.28	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2032.24	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2438.69	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.89	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		159.41	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	159.41	(331)
Energy for lighting (calculated in Appendix L)		317.09	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4135.4	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1095.13	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.78	(372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1117.91	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1117.91	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	82.74	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	164.57	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =			986.31	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14	(384)
EI rating (section 14)				88.55	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.49

Property Address: Block I - Mid Floor

Address : I, Block I, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.44	(1a) x	2.5	(2a) =	176.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.44	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		176.1	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 2			5.88	x1/[1/(1.2)+ 0.04]		=	6.73			(27)
Windows Type 3			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 4			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Walls Type1	34.17	13.17	21	x	0.16	=	3.36			(29)
Walls Type2	31.98	1.91	30.07	x	0.15	=	4.52			(29)
Total area of elements, m²			66.15							(31)
Party wall			21.75	x	0	=	0			(32)
Party floor			70.44							(32a)
Party ceiling			70.44							(32b)

** 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) = 24.87 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6369.18 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 6.24 (36)

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

Total fabric heat loss (33) + (36) = 31.11 (37)

DER WorkSheet: New dwelling design stage

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=	17.2	17	16.79	15.78	15.57	14.56	14.56	14.35	14.96	15.57	15.98	16.39	(38)

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

(39)m=	48.31	48.11	47.91	46.89	46.69	45.67	45.67	45.47	46.08	46.69	47.09	47.5	

Average = Sum(39)$_{1...12}$ /12= 46.84 (39)

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

(40)m=	0.69	0.68	0.68	0.67	0.66	0.65	0.65	0.65	0.65	0.66	0.67	0.67	

Average = Sum(40)$_{1...12}$ /12= 0.66 (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 2.26 (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 87.8 (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=	96.58	93.07	89.55	86.04	82.53	79.02	79.02	82.53	86.04	89.55	93.07	96.58	

Total = Sum(44)$_{1...12}$ = 1053.58 (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=	143.22	125.26	129.26	112.69	108.13	93.31	86.46	99.22	100.4	117.01	127.73	138.7	

Total = Sum(45)$_{1...12}$ = 1381.41 (45)

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

(46)m=	21.48	18.79	19.39	16.9	16.22	14	12.97	14.88	15.06	17.55	19.16	20.81	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	198.5	175.19	184.54	166.19	163.41	146.8	141.74	154.5	153.9	172.29	181.22	193.98	(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=	198.5	175.19	184.54	166.19	163.41	146.8	141.74	154.5	153.9	172.29	181.22	193.98

Output from water heater (annual)$_{1...12}$ — 2032.24 (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=	91.84	81.59	87.2	80.27	80.17	73.82	72.97	77.21	76.18	83.13	85.26	90.34	(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=	112.84	112.84	112.84	112.84	112.84	112.84	112.84	112.84	112.84	112.84	112.84	112.84	(66)

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

(67)m=	17.95	15.95	12.97	9.82	7.34	6.2	6.7	8.7	11.68	14.83	17.31	18.45	(67)

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

(68)m=	198.32	200.38	195.19	184.15	170.22	157.12	148.37	146.31	151.5	162.54	176.47	189.57	(68)

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

(69)m=	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	(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=	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	-90.27	(71)

Water heating gains (Table 5)

(72)m=	123.44	121.42	117.2	111.48	107.76	102.53	98.08	103.78	105.8	111.73	118.42	121.42	(72)

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

(73)m=	396.57	394.59	382.22	362.3	342.17	322.69	309.99	315.64	325.83	345.95	369.06	386.3	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

Southwest	0.9x	0.77	x	2.43	x	36.79		0.45	x	0.7	=	19.52	(79)
Southwest	0.9x	0.77	x	2.43	x	62.67		0.45	x	0.7	=	33.25	(79)
Southwest	0.9x	0.77	x	2.43	x	85.75		0.45	x	0.7	=	45.49	(79)
Southwest	0.9x	0.77	x	2.43	x	106.25		0.45	x	0.7	=	56.36	(79)
Southwest	0.9x	0.77	x	2.43	x	119.01		0.45	x	0.7	=	63.13	(79)
Southwest	0.9x	0.77	x	2.43	x	118.15		0.45	x	0.7	=	62.67	(79)
Southwest	0.9x	0.77	x	2.43	x	113.91		0.45	x	0.7	=	60.42	(79)
Southwest	0.9x	0.77	x	2.43	x	104.39		0.45	x	0.7	=	55.37	(79)
Southwest	0.9x	0.77	x	2.43	x	92.85		0.45	x	0.7	=	49.25	(79)
Southwest	0.9x	0.77	x	2.43	x	69.27		0.45	x	0.7	=	36.74	(79)
Southwest	0.9x	0.77	x	2.43	x	44.07		0.45	x	0.7	=	23.38	(79)
Southwest	0.9x	0.77	x	2.43	x	31.49		0.45	x	0.7	=	16.7	(79)
Northwest	0.9x	0.77	x	5.88	x	11.28	x	0.45	x	0.7	=	14.48	(81)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	5.88	x	22.97	x	0.45	x	0.7	=	29.48	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	5.88	x	41.38	x	0.45	x	0.7	=	53.11	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	5.88	x	67.96	x	0.45	x	0.7	=	87.23	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	5.88	x	91.35	x	0.45	x	0.7	=	117.25	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest	0.9x	0.77	x	5.88	x	97.38	x	0.45	x	0.7	=	125	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	5.88	x	91.1	x	0.45	x	0.7	=	116.94	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	5.88	x	72.63	x	0.45	x	0.7	=	93.22	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	5.88	x	50.42	x	0.45	x	0.7	=	64.72	(81)
Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	5.88	x	28.07	x	0.45	x	0.7	=	36.03	(81)
Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)

Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest	0.9x	0.77	x	5.88	x	14.2	x	0.45	x	0.7	=	18.22	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	5.88	x	9.21	x	0.45	x	0.7	=	11.83	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)

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

(83)m=	45.97	87.09	142.5	215.68	277.29	290.99	274.01	225.65	167.46	102.55	56.66	38.31	(83)

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

(84)m=	442.54	481.69	524.72	577.99	619.46	613.68	584	541.29	493.3	448.5	425.72	424.61	(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=	0.95	0.93	0.88	0.78	0.63	0.46	0.34	0.38	0.6	0.82	0.92	0.95	(86)

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

(87)m=	19.83	20.01	20.3	20.65	20.87	20.97	20.99	20.99	20.93	20.64	20.2	19.81	(87)

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

(88)m=	20.35	20.36	20.36	20.37	20.37	20.39	20.39	20.39	20.38	20.37	20.37	20.36	(88)

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

(89)m=	0.94	0.92	0.87	0.76	0.6	0.42	0.29	0.33	0.55	0.8	0.91	0.95	(89)

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

(90)m=	18.77	19.02	19.44	19.94	20.23	20.36	20.38	20.38	20.31	19.93	19.31	18.74	(90)

fLA = Living area ÷ (4) = 0.36 (91)

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

(92)m=	19.15	19.38	19.75	20.19	20.46	20.58	20.6	20.6	20.53	20.19	19.63	19.12	(92)

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

(93)m=	19.15	19.38	19.75	20.19	20.46	20.58	20.6	20.6	20.53	20.19	19.63	19.12	(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=	0.93	0.9	0.86	0.75	0.61	0.43	0.31	0.35	0.56	0.79	0.9	0.94	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.89	435.82	449.2	436.34	375.74	266.32	181.34	188.78	277.92	354.63	381.86	397.24	(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=	717.4	696.53	634.67	529.53	409.08	273.13	182.77	190.99	296.27	447.71	590.16	708.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	228.04	175.2	137.99	67.09	24.81	0	0	0	0	69.25	149.98	231.87	

DER WorkSheet: New dwelling design stage

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1084.23	(98)
Space heating requirement in kWh/m²/year		15.39	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1084.23	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1301.07	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2032.24	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2438.69	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	37.4	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		159.41	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	159.41	(331)
Energy for lighting (calculated in Appendix L)		317.09	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3486.19	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	933.14	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.41	(372)

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DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	952.55	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			952.55	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	82.74	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	164.57	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =			820.95	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			11.65	(384)
EI rating (section 14)				90.47	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.49

Property Address: Block I - Top Floor

Address : I, Block I, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	52.5	(1a)	x	2.5	(2a)	=	131.25	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	131.25	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			6	x1/[1/(1.2)+ 0.04]		=	6.87			(27)
Windows Type 2			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 3			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 4			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Walls Type1	47.5	13.29	34.21	x	0.16	=	5.47			(29)
Walls Type2	8	1.91	6.09	x	0.15	=	0.92			(29)
Roof	52.5	0	52.5	x	0.1	=	5.25			(30)
Total area of elements, m²			108							(31)
Party wall			34.28	x	0	=	0			(32)
Party floor			52.5							(32a)

** 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) = 28.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4477.58 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 16.93 (36)

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

Total fabric heat loss (33) + (36) = 45.7 (37)

DER WorkSheet: New dwelling design stage

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=	12.82	12.67	12.52	11.76	11.61	10.85	10.85	10.7	11.15	11.61	11.91	12.21	(38)

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

(39)m=	58.52	58.37	58.22	57.46	57.31	56.55	56.55	56.4	56.85	57.31	57.61	57.91	

Average = $Sum(39)_{1...12}$ /12= 57.42 (39)

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

(40)m=	1.11	1.11	1.11	1.09	1.09	1.08	1.08	1.07	1.08	1.09	1.1	1.1	

Average = $Sum(40)_{1...12}$ /12= 1.09 (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 1.76 (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 76.09 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	83.7	80.66	77.61	74.57	71.53	68.48	68.48	71.53	74.57	77.61	80.66	83.7	

Total = $Sum(44)_{1...12}$ = 913.09 (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=	124.12	108.56	112.02	97.67	93.71	80.87	74.93	85.99	87.02	101.41	110.7	120.21	

Total = $Sum(45)_{1...12}$ = 1197.2 (45)

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

(46)m=	18.62	16.28	16.8	14.65	14.06	12.13	11.24	12.9	13.05	15.21	16.6	18.03	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	179.4	158.49	167.3	151.16	148.99	134.36	130.21	141.27	140.51	156.69	164.19	175.48	(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=	179.4	158.49	167.3	151.16	148.99	134.36	130.21	141.27	140.51	156.69	164.19	175.48

Output from water heater (annual)$_{1...12}$ | 1848.04 | (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=	85.49	76.04	81.47	75.27	75.38	69.68	69.14	72.81	71.73	77.94	79.6	84.19	(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=	88.19	88.19	88.19	88.19	88.19	88.19	88.19	88.19	88.19	88.19	88.19	88.19	(66)

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

(67)m=	13.7	12.17	9.9	7.49	5.6	4.73	5.11	6.64	8.92	11.32	13.21	14.09	(67)

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

(68)m=	153.72	155.32	151.3	142.74	131.94	121.79	115	113.41	117.43	125.98	136.79	146.94	(68)

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

(69)m=	31.82	31.82	31.82	31.82	31.82	31.82	31.82	31.82	31.82	31.82	31.82	31.82	(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=	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	-70.55	(71)

Water heating gains (Table 5)

(72)m=	114.91	113.15	109.5	104.54	101.32	96.78	92.93	97.87	99.62	104.76	110.56	113.16	(72)

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

(73)m=	331.79	330.1	320.16	304.23	288.32	272.75	262.5	267.37	275.42	291.52	310.01	323.64	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southwest	0.9x	0.77	x	6	x	36.79		0.45	x	0.7	=	48.19	(79)
Southwest	0.9x	0.77	x	6	x	62.67		0.45	x	0.7	=	82.09	(79)
Southwest	0.9x	0.77	x	6	x	85.75		0.45	x	0.7	=	112.32	(79)
Southwest	0.9x	0.77	x	6	x	106.25		0.45	x	0.7	=	139.17	(79)
Southwest	0.9x	0.77	x	6	x	119.01		0.45	x	0.7	=	155.88	(79)

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Southwest	0.9x	0.77	x	6	x	118.15	0.45	x	0.7	=	154.75	(79)
Southwest	0.9x	0.77	x	6	x	113.91	0.45	x	0.7	=	149.19	(79)
Southwest	0.9x	0.77	x	6	x	104.39	0.45	x	0.7	=	136.73	(79)
Southwest	0.9x	0.77	x	6	x	92.85	0.45	x	0.7	=	121.61	(79)
Southwest	0.9x	0.77	x	6	x	69.27	0.45	x	0.7	=	90.72	(79)
Southwest	0.9x	0.77	x	6	x	44.07	0.45	x	0.7	=	57.72	(79)
Southwest	0.9x	0.77	x	6	x	31.49	0.45	x	0.7	=	41.24	(79)

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

(83)m=	106.74	181.82	248.78	308.25	345.27	342.77	330.47	302.85	269.38	200.95	127.85	91.35	(83)

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

(84)m=	438.54	511.92	568.94	612.48	633.58	615.52	592.96	570.23	544.8	492.48	437.87	414.99	(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=	0.93	0.9	0.85	0.77	0.66	0.52	0.4	0.42	0.6	0.79	0.9	0.94	(86)

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

(87)m=	19.04	19.35	19.76	20.23	20.61	20.86	20.95	20.94	20.78	20.29	19.59	18.98	(87)

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

(88)m=	19.99	19.99	19.99	20.01	20.01	20.02	20.02	20.02	20.01	20.01	20	20	(88)

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

(89)m=	0.92	0.89	0.83	0.74	0.62	0.46	0.32	0.34	0.54	0.76	0.88	0.93	(89)

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

(90)m=	17.4	17.83	18.42	19.08	19.58	19.89	19.99	19.98	19.8	19.17	18.2	17.32	(90)

fLA = Living area ÷ (4) = 0.52 (91)

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

(92)m=	18.26	18.63	19.12	19.68	20.12	20.4	20.49	20.48	20.31	19.76	18.93	18.19	(92)

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

(93)m=	18.26	18.63	19.12	19.68	20.12	20.4	20.49	20.48	20.31	19.76	18.93	18.19	(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=	0.9	0.86	0.81	0.73	0.62	0.48	0.35	0.38	0.56	0.75	0.86	0.91	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	395.3	442.46	462.38	449.14	395.54	297.28	210.5	218.21	305.2	370.45	378.57	378.12	(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=	816.75	801.12	734.61	619.53	482.5	327.85	220.08	230.23	353.19	524.81	681.29	810.22	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	313.56	241.02	202.54	122.68	64.7	0	0	0	0	114.84	217.96	321.48	(98)

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1598.78	(98)
Space heating requirement in kWh/m²/year		30.45	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1598.78	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1918.54	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1848.04	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2217.65	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.36	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		100.08	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	100.08	(331)
Energy for lighting (calculated in Appendix L)		242.03	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3748.22	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1032.06	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.47	(372)

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Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1053.53	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1053.53	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	51.94	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	125.61	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =			852.17	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.23	(384)
EI rating (section 14)				88.29	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.49

Property Address: Block M - Ground Floor

Address : M, Block M, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.09	(1a) x	2.5	(2a) =	125.23	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.09	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	125.23	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(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 *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*		0	(11)
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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 2			7.56	x1/[1/(1.2)+ 0.04]		=	8.66			(27)
Floor			50.09	x	0.1	=	5.009			(28)
Walls Type1	22.45	9.99	12.46	x	0.16	=	1.99			(29)
Walls Type2	28.62	1.91	26.72	x	0.15	=	4.02			(29)
Total area of elements, m²			101.17							(31)
Party wall			30.58	x	0	=	0			(32)
Party ceiling			50.09							(32b)

** 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) =	24.37	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	8741.05	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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		8.51	(36)

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

Total fabric heat loss	(33) + (36) =	32.88	(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=	12.23	12.09	11.94	11.22	11.07	10.35	10.35	10.21	10.64	11.07	11.36	11.65	(38)

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

(39)m=	45.11	44.97	44.82	44.1	43.96	43.23	43.23	43.09	43.52	43.96	44.25	44.53	

Average = Sum(39)$_{1…12}$ /12= 44.06 (39)

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

(40)m=	0.9	0.9	0.89	0.88	0.88	0.86	0.86	0.86	0.87	0.88	0.88	0.89

Average = Sum(40)$_{1...12}$ /12= 0.88 (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 1.69 (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 74.4 (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=	81.84	78.87	75.89	72.91	69.94	66.96	66.96	69.94	72.91	75.89	78.87	81.84	
										Total = Sum(44)$_{1...12}$ =		892.83	(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=	121.37	106.15	109.54	95.5	91.63	79.07	73.27	84.08	85.09	99.16	108.24	117.54	
										Total = Sum(45)$_{1...12}$ =		1170.65	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.21	15.92	16.43	14.32	13.75	11.86	10.99	12.61	12.76	14.87	16.24	17.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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)

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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=	176.65	156.08	164.82	148.99	146.91	132.57	128.55	139.36	138.58	154.44	161.73	172.82	(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=	176.65	156.08	164.82	148.99	146.91	132.57	128.55	139.36	138.58	154.44	161.73	172.82	

Output from water heater (annual)$_{1...12}$ 1821.49 (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=	84.58	75.24	80.64	74.55	74.69	69.09	68.58	72.18	71.09	77.19	78.78	83.3	(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=	84.64	84.64	84.64	84.64	84.64	84.64	84.64	84.64	84.64	84.64	84.64	84.64	(66)

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

(67)m=	13.24	11.76	9.57	7.24	5.41	4.57	4.94	6.42	8.62	10.94	12.77	13.61	(67)

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

(68)m=	147.47	149	145.14	136.93	126.57	116.83	110.32	108.79	112.65	120.86	131.22	140.96	(68)

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

(69)m=	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	(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=	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	(71)

Water heating gains (Table 5)

(72)m=	113.68	111.96	108.39	103.54	100.39	95.95	92.18	97.01	98.73	103.75	109.42	111.97	(72)

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

(73)m=	322.78	321.11	311.49	296.11	280.76	265.75	255.84	260.62	268.39	283.94	301.8	314.93	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	7.56	x	36.79	x	0.45	x	0.7	=	60.72	(77)
Southeast 0.9x	0.77	x	7.56	x	62.67	x	0.45	x	0.7	=	103.43	(77)
Southeast 0.9x	0.77	x	7.56	x	85.75	x	0.45	x	0.7	=	141.52	(77)
Southeast 0.9x	0.77	x	7.56	x	106.25	x	0.45	x	0.7	=	175.35	(77)
Southeast 0.9x	0.77	x	7.56	x	119.01	x	0.45	x	0.7	=	196.4	(77)

Southeast	0.9x	0.77	x	7.56	x	118.15	x	0.45	x	0.7	=	194.98	(77)
Southeast	0.9x	0.77	x	7.56	x	113.91	x	0.45	x	0.7	=	187.99	(77)
Southeast	0.9x	0.77	x	7.56	x	104.39	x	0.45	x	0.7	=	172.28	(77)
Southeast	0.9x	0.77	x	7.56	x	92.85	x	0.45	x	0.7	=	153.23	(77)
Southeast	0.9x	0.77	x	7.56	x	69.27	x	0.45	x	0.7	=	114.31	(77)
Southeast	0.9x	0.77	x	7.56	x	44.07	x	0.45	x	0.7	=	72.73	(77)
Southeast	0.9x	0.77	x	7.56	x	31.49	x	0.45	x	0.7	=	51.96	(77)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)

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

(83)m=	66.71	115.61	163.47	211.4	244.86	246.64	236.31	210.8	179.98	129.2	80.26	56.85	(83)

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

(84)m=	389.49	436.73	474.96	507.5	525.62	512.39	492.15	471.42	448.37	413.14	382.06	371.78	(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=	0.93	0.9	0.86	0.77	0.65	0.5	0.37	0.4	0.59	0.79	0.9	0.94	(86)

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

(87)m=	19.47	19.71	20.05	20.45	20.75	20.92	20.98	20.97	20.86	20.49	19.93	19.43	(87)

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

(88)m=	20.17	20.17	20.17	20.18	20.19	20.2	20.2	20.2	20.19	20.19	20.18	20.18	(88)

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

(89)m=	0.92	0.89	0.84	0.75	0.62	0.45	0.31	0.34	0.54	0.76	0.89	0.93	(89)

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

(90)m=	18.13	18.47	18.95	19.51	19.9	20.13	20.18	20.18	20.06	19.58	18.8	18.08	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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

(92)m=	18.72	19.02	19.44	19.92	20.28	20.48	20.53	20.53	20.41	19.98	19.3	18.68	(92)

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

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(93)m=	18.72	19.02	19.44	19.92	20.28	20.48	20.53	20.53	20.41	19.98	19.3	18.68	(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=	0.9	0.87	0.82	0.74	0.62	0.47	0.34	0.37	0.55	0.76	0.87	0.91	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	352.27	381.26	391.21	375.45	326.07	239.2	166.1	172.7	248.32	312.34	331.5	339.55	(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=	650.74	634.93	579.86	486.15	376.96	254.13	170.08	177.92	274.79	412.39	539.79	644.79	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	222.06	170.46	140.35	79.7	37.86	0	0	0	0	74.43	149.97	227.1	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1101.95 (98)

Space heating requirement in kWh/m²/year 22 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1101.95	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1322.34	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1821.49	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2185.78	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	35.08	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		113.36	(330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	113.36	(331)
Energy for lighting (calculated in Appendix L)		233.88	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3125.29	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	875.34	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.21	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	893.55	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				893.55	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	58.83	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	121.38	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1			0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				694.86	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				13.87	(384)
EI rating (section 14)					90.21	(385)

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User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.49

Property Address: Block M - Mid Floor

Address : M, Block M, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.09	(1a) x	2.5	(2a) =	125.23	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.09	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	125.23	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 2			7.56	x1/[1/(1.2)+ 0.04]		=	8.66			(27)
Walls Type1	22.45	9.99	12.46	x	0.16	=	1.99			(29)
Walls Type2	28.62	1.91	26.72	x	0.15	=	4.02			(29)
Total area of elements, m²			51.08							(31)
Party wall			30.58	x	0	=	0			(32)
Party floor			50.09							(32a)
Party ceiling			50.09							(32b)

* *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) =	19.36	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	5234.75	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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		4.71	(36)

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

Total fabric heat loss	(33) + (36) =	24.07	(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=	12.23	12.09	11.94	11.22	11.07	10.35	10.35	10.21	10.64	11.07	11.36	11.65	(38)

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

(39)m=	36.3	36.16	36.02	35.29	35.15	34.42	34.42	34.28	34.71	35.15	35.44	35.73	

Average = Sum(39)$_{1…12}$ /12= 35.26 (39)

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

(40)m=	0.72	0.72	0.72	0.7	0.7	0.69	0.69	0.68	0.69	0.7	0.71	0.71

Average = Sum(40)$_{1...12}$ /12= 0.7 (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 1.69 (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 74.4 (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=	81.84	78.87	75.89	72.91	69.94	66.96	66.96	69.94	72.91	75.89	78.87	81.84	
										Total = Sum(44)$_{1...12}$ =		892.83	(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=	121.37	106.15	109.54	95.5	91.63	79.07	73.27	84.08	85.09	99.16	108.24	117.54	
										Total = Sum(45)$_{1...12}$ =		1170.65	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.21	15.92	16.43	14.32	13.75	11.86	10.99	12.61	12.76	14.87	16.24	17.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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)

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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=	176.65	156.08	164.82	148.99	146.91	132.57	128.55	139.36	138.58	154.44	161.73	172.82	(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=	176.65	156.08	164.82	148.99	146.91	132.57	128.55	139.36	138.58	154.44	161.73	172.82	

Output from water heater (annual)$_{1\ldots12}$ | 1821.49 | (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=	84.58	75.24	80.64	74.55	74.69	69.09	68.58	72.18	71.09	77.19	78.78	83.3	(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=	84.64	84.64	84.64	84.64	84.64	84.64	84.64	84.64	84.64	84.64	84.64	84.64	(66)

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

(67)m=	13.24	11.76	9.57	7.24	5.41	4.57	4.94	6.42	8.62	10.94	12.77	13.61	(67)

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

(68)m=	147.47	149	145.14	136.93	126.57	116.83	110.32	108.79	112.65	120.86	131.22	140.96	(68)

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

(69)m=	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	(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=	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	-67.71	(71)

Water heating gains (Table 5)

(72)m=	113.68	111.96	108.39	103.54	100.39	95.95	92.18	97.01	98.73	103.75	109.42	111.97	(72)

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

(73)m=	322.78	321.11	311.49	296.11	280.76	265.75	255.84	260.62	268.39	283.94	301.8	314.93	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	7.56	x	36.79	x	0.45	x	0.7	=	60.72	(77)
Southeast 0.9x	0.77	x	7.56	x	62.67	x	0.45	x	0.7	=	103.43	(77)
Southeast 0.9x	0.77	x	7.56	x	85.75	x	0.45	x	0.7	=	141.52	(77)
Southeast 0.9x	0.77	x	7.56	x	106.25	x	0.45	x	0.7	=	175.35	(77)
Southeast 0.9x	0.77	x	7.56	x	119.01	x	0.45	x	0.7	=	196.4	(77)

Southeast 0.9x	0.77	x	7.56	x	118.15	x	0.45	x	0.7	=	194.98	(77)
Southeast 0.9x	0.77	x	7.56	x	113.91	x	0.45	x	0.7	=	187.99	(77)
Southeast 0.9x	0.77	x	7.56	x	104.39	x	0.45	x	0.7	=	172.28	(77)
Southeast 0.9x	0.77	x	7.56	x	92.85	x	0.45	x	0.7	=	153.23	(77)
Southeast 0.9x	0.77	x	7.56	x	69.27	x	0.45	x	0.7	=	114.31	(77)
Southeast 0.9x	0.77	x	7.56	x	44.07	x	0.45	x	0.7	=	72.73	(77)
Southeast 0.9x	0.77	x	7.56	x	31.49	x	0.45	x	0.7	=	51.96	(77)
Northwest 0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest 0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest 0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest 0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest 0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest 0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest 0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest 0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest 0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest 0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest 0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest 0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)

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

(83)m=	66.71	115.61	163.47	211.4	244.86	246.64	236.31	210.8	179.98	129.2	80.26	56.85	(83)

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

(84)m=	389.49	436.73	474.96	507.5	525.62	512.39	492.15	471.42	448.37	413.14	382.06	371.78	(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=	0.91	0.88	0.82	0.71	0.57	0.42	0.31	0.33	0.51	0.73	0.87	0.92	(86)

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

(87)m=	19.95	20.17	20.44	20.72	20.9	20.98	20.99	20.99	20.95	20.74	20.33	19.92	(87)

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

(88)m=	20.32	20.32	20.32	20.34	20.34	20.35	20.35	20.35	20.35	20.34	20.33	20.33	(88)

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

(89)m=	0.91	0.87	0.8	0.69	0.54	0.38	0.26	0.29	0.47	0.71	0.86	0.92	(89)

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

(90)m=	18.92	19.22	19.6	20	20.22	20.33	20.35	20.35	20.3	20.02	19.46	18.88	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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

(92)m=	19.38	19.64	19.97	20.32	20.52	20.62	20.63	20.63	20.59	20.34	19.84	19.34	(92)

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

(93)m=	19.38	19.64	19.97	20.32	20.52	20.62	20.63	20.63	20.59	20.34	19.84	19.34	(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=	0.89	0.85	0.79	0.69	0.55	0.4	0.28	0.31	0.48	0.71	0.84	0.9	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	346.94	371.79	375.05	348.19	289.65	202.68	137.94	143.85	215.86	291.48	322.33	335.04	(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=	547.32	532.94	485.13	402.97	310.03	207.09	138.88	145.13	225.16	342.35	451.55	540.87	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	149.08	108.29	81.9	39.45	15.16	0	0	0	0	37.85	93.04	153.14	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 677.9 (98)

Space heating requirement in kWh/m²/year 13.53 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		677.9	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	813.49	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1821.49	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2185.78	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	29.99	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		113.36	(330a)

warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	113.36	(331)
Energy for lighting (calculated in Appendix L)		233.88	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		2616.44	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	748.38	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	15.57	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	763.94	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				763.94	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	58.83	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	121.38	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				565.25	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				11.28	(384)
EI rating (section 14)					92.03	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block M - Top Floor

Address : M, Block M, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.71	(1a) x	2.5	(2a) =	214.27	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.71	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	214.27	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			6	x1/[1/(1.2)+ 0.04]		=	6.87			(27)
Windows Type 2			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 3			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 4			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Walls Type1	37.1	13.29	23.81	x	0.16	=	3.81			(29)
Walls Type2	16.35	1.91	14.44	x	0.15	=	2.17			(29)
Roof	85.71	0	85.71	x	0.1	=	8.57			(30)
Total area of elements, m²			139.16							(31)
Party wall			47.58	x	0	=	0			(32)
Party floor			85.71							(32a)

** 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) = 31.68 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6684.91 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 12.54 (36)

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

Total fabric heat loss (33) + (36) = 44.22 (37)

DER WorkSheet: New dwelling design stage

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=	20.93	20.68	20.44	19.2	18.95	17.71	17.71	17.47	18.21	18.95	19.45	19.94	(38)

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

(39)m=	65.15	64.9	64.65	63.42	63.17	61.93	61.93	61.68	62.43	63.17	63.66	64.16	

Average = Sum(39)$_{1…12}$ /12= 63.35 (39)

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

(40)m=	0.76	0.76	0.75	0.74	0.74	0.72	0.72	0.72	0.73	0.74	0.74	0.75	

Average = Sum(40)$_{1…12}$ /12= 0.74 (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 2.56 (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 95.06 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	104.56	100.76	96.96	93.15	89.35	85.55	85.55	89.35	93.15	96.96	100.76	104.56

Total = Sum(44)$_{1…12}$ = 1140.67 (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=	155.06	135.62	139.94	122.01	117.07	101.02	93.61	107.42	108.7	126.68	138.28	150.17

Total = Sum(45)$_{1…12}$ = 1495.59 (45)

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

(46)m=	23.26	20.34	20.99	18.3	17.56	15.15	14.04	16.11	16.31	19	20.74	22.53	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	210.34	185.54	195.22	175.5	172.35	154.52	148.89	162.7	162.2	181.96	191.78	205.45	(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=	210.34	185.54	195.22	175.5	172.35	154.52	148.89	162.7	162.2	181.96	191.78	205.45

Output from water heater (annual)$_{1...12}$ — 2146.43 (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=	95.78	85.03	90.75	83.36	83.15	76.38	75.35	79.94	78.94	86.34	88.77	94.15	(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=	128.12	128.12	128.12	128.12	128.12	128.12	128.12	128.12	128.12	128.12	128.12	128.12	(66)

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

(67)m=	21.62	19.2	15.61	11.82	8.84	7.46	8.06	10.48	14.06	17.86	20.84	22.22	(67)

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

(68)m=	230.96	233.36	227.32	214.46	198.23	182.98	172.79	170.39	176.43	189.29	205.52	220.77	(68)

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

(69)m=	35.81	35.81	35.81	35.81	35.81	35.81	35.81	35.81	35.81	35.81	35.81	35.81	(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=	-102.49	-102.49	-102.49	-102.49	-102.49	-102.49	-102.49	-102.49	-102.49	-102.49	-102.49	-102.49	(71)

Water heating gains (Table 5)

(72)m=	128.74	126.54	121.98	115.78	111.76	106.09	101.27	107.44	109.64	116.05	123.3	126.55	(72)

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

(73)m=	442.75	440.53	426.35	403.5	380.26	357.96	343.55	349.75	361.56	384.63	411.09	430.97	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Northwest	0.9x	0.77	x	6	x	11.28	x	0.45	x	0.7	=	14.78	(81)
Northwest	0.9x	0.77	x	6	x	22.97	x	0.45	x	0.7	=	30.08	(81)
Northwest	0.9x	0.77	x	6	x	41.38	x	0.45	x	0.7	=	54.2	(81)
Northwest	0.9x	0.77	x	6	x	67.96	x	0.45	x	0.7	=	89.01	(81)
Northwest	0.9x	0.77	x	6	x	91.35	x	0.45	x	0.7	=	119.64	(81)

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Northwest	0.9x	0.77	x	6	x	97.38	x	0.45	x	0.7	=	127.55	(81)
Northwest	0.9x	0.77	x	6	x	91.1	x	0.45	x	0.7	=	119.32	(81)
Northwest	0.9x	0.77	x	6	x	72.63	x	0.45	x	0.7	=	95.12	(81)
Northwest	0.9x	0.77	x	6	x	50.42	x	0.45	x	0.7	=	66.04	(81)
Northwest	0.9x	0.77	x	6	x	28.07	x	0.45	x	0.7	=	36.76	(81)
Northwest	0.9x	0.77	x	6	x	14.2	x	0.45	x	0.7	=	18.59	(81)
Northwest	0.9x	0.77	x	6	x	9.21	x	0.45	x	0.7	=	12.07	(81)

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

(83)m=	73.33	129.82	190.66	258.09	309.03	315.57	300.59	261.25	213.8	146.99	88.73	62.18	(83)

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

(84)m=	516.08	570.35	617.01	661.59	689.29	673.53	644.15	610.99	575.37	531.62	499.82	493.15	(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=	0.96	0.94	0.9	0.83	0.71	0.55	0.41	0.45	0.66	0.85	0.94	0.96	(86)

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

(87)m=	19.57	19.77	20.08	20.47	20.77	20.93	20.98	20.98	20.87	20.5	19.99	19.54	(87)

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

(88)m=	20.29	20.29	20.29	20.31	20.31	20.32	20.32	20.32	20.32	20.31	20.3	20.3	(88)

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

(89)m=	0.95	0.93	0.89	0.81	0.68	0.5	0.35	0.39	0.61	0.83	0.93	0.96	(89)

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

(90)m=	18.35	18.64	19.09	19.64	20.04	20.26	20.31	20.3	20.18	19.7	18.96	18.31	(90)

fLA = Living area ÷ (4) = 0.32 (91)

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

(92)m=	18.74	19.01	19.41	19.91	20.27	20.48	20.53	20.52	20.41	19.96	19.3	18.71	(92)

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

(93)m=	18.74	19.01	19.41	19.91	20.27	20.48	20.53	20.52	20.41	19.96	19.3	18.71	(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=	0.94	0.92	0.88	0.8	0.68	0.51	0.37	0.41	0.62	0.82	0.91	0.95	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	484.28	522.4	540.44	528.24	466.59	344.07	238.39	247.66	354.18	434.74	455.45	466.06	(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=	940.99	915.56	834.72	698.3	541.61	363.93	243.15	254.25	393.61	591.17	776.39	930.96	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	339.79	264.2	218.95	122.45	55.81	0	0	0	0	116.38	231.07	345.89	

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1694.54	(98)
Space heating requirement in kWh/m²/year		19.77	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1694.54	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2033.44	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2146.43	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2575.72	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	46.09	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		173.19	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	173.19	(331)
Energy for lighting (calculated in Appendix L)		381.77	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4434.04	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1150.07	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	23.92	(372)

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Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1174	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1174	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	89.88	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	198.14	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =			1083.11	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			12.64	(384)
EI rating (section 14)				88.9	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block N - Ground Floor

Address : N, Block N, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	50.14	(1a)	x	2.5	(2a)	=	125.35	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.14	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			125.35	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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 *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*		0	(11)
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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			1.46	x1/[1/(1.2)+ 0.04]		=	1.67			(27)
Windows Type 2			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 3			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 4			6	x1/[1/(1.2)+ 0.04]		=	6.87			(27)
Floor			50.14	x	0.1	=	5.014			(28)
Walls Type1	42.2	13.13	29.07	x	0.16	=	4.65			(29)
Walls Type2	22.4	1.91	20.49	x	0.15	=	3.08			(29)
Total area of elements, m²			114.74							(31)
Party wall			10.45	x	0	=	0			(32)
Party ceiling			50.14							(32b)

** 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) = 29.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7935.89 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 9.08 (36)

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

Total fabric heat loss (33) + (36) = 38.77 (37)

DER WorkSheet: New dwelling design stage

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=	12.24	12.1	11.95	11.23	11.09	10.36	10.36	10.22	10.65	11.09	11.38	11.67	(38)

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

(39)m=	51.01	50.87	50.72	50	49.85	49.13	49.13	48.98	49.42	49.85	50.14	50.43	

Average = Sum(39)$_{1…12}$ /12= 49.96 (39)

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

(40)m=	1.02	1.01	1.01	1	0.99	0.98	0.98	0.98	0.99	0.99	1	1.01	

Average = Sum(40)$_{1…12}$ /12= 1 (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 1.69 (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 74.44 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	81.88	78.9	75.93	72.95	69.97	66.99	66.99	69.97	72.95	75.93	78.9	81.88	

Total = Sum(44)$_{1…12}$ = 893.25 (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=	121.43	106.2	109.59	95.54	91.68	79.11	73.31	84.12	85.13	99.21	108.29	117.6	

Total = Sum(45)$_{1…12}$ = 1171.2 (45)

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

(46)m=	18.21	15.93	16.44	14.33	13.75	11.87	11	12.62	12.77	14.88	16.24	17.64	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	176.7	156.13	164.87	149.04	146.95	132.6	128.58	139.4	138.62	154.48	161.78	172.87	(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=	176.7	156.13	164.87	149.04	146.95	132.6	128.58	139.4	138.62	154.48	161.78	172.87

Output from water heater (annual)$_{1...12}$ — 1822.04 (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=	84.6	75.25	80.66	74.56	74.7	69.1	68.6	72.19	71.1	77.21	78.8	83.32	(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=	84.71	84.71	84.71	84.71	84.71	84.71	84.71	84.71	84.71	84.71	84.71	84.71	(66)

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

(67)m=	13.16	11.69	9.5	7.2	5.38	4.54	4.91	6.38	8.56	10.87	12.69	13.52	(67)

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

(68)m=	147.6	149.13	145.27	137.05	126.68	116.93	110.42	108.89	112.75	120.96	131.34	141.09	(68)

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

(69)m=	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	(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=	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	(71)

Water heating gains (Table 5)

(72)m=	113.7	111.99	108.41	103.56	100.41	95.97	92.2	97.03	98.75	103.77	109.45	111.99	(72)

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

(73)m=	322.87	321.21	311.6	296.22	280.88	265.86	255.94	260.71	268.47	284.02	301.88	315.01	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

Northeast	0.9x	0.77	x	3.24	x	11.28	x	0.45	x	0.7	=	7.98	(75)
Northeast	0.9x	0.77	x	6	x	11.28	x	0.45	x	0.7	=	14.78	(75)
Northeast	0.9x	0.77	x	3.24	x	22.97	x	0.45	x	0.7	=	16.24	(75)
Northeast	0.9x	0.77	x	6	x	22.97	x	0.45	x	0.7	=	30.08	(75)
Northeast	0.9x	0.77	x	3.24	x	41.38	x	0.45	x	0.7	=	29.27	(75)
Northeast	0.9x	0.77	x	6	x	41.38	x	0.45	x	0.7	=	54.2	(75)
Northeast	0.9x	0.77	x	3.24	x	67.96	x	0.45	x	0.7	=	48.06	(75)
Northeast	0.9x	0.77	x	6	x	67.96	x	0.45	x	0.7	=	89.01	(75)
Northeast	0.9x	0.77	x	3.24	x	91.35	x	0.45	x	0.7	=	64.61	(75)
Northeast	0.9x	0.77	x	6	x	91.35	x	0.45	x	0.7	=	119.64	(75)
Northeast	0.9x	0.77	x	3.24	x	97.38	x	0.45	x	0.7	=	68.88	(75)
Northeast	0.9x	0.77	x	6	x	97.38	x	0.45	x	0.7	=	127.55	(75)
Northeast	0.9x	0.77	x	3.24	x	91.1	x	0.45	x	0.7	=	64.43	(75)
Northeast	0.9x	0.77	x	6	x	91.1	x	0.45	x	0.7	=	119.32	(75)
Northeast	0.9x	0.77	x	3.24	x	72.63	x	0.45	x	0.7	=	51.37	(75)
Northeast	0.9x	0.77	x	6	x	72.63	x	0.45	x	0.7	=	95.12	(75)
Northeast	0.9x	0.77	x	3.24	x	50.42	x	0.45	x	0.7	=	35.66	(75)
Northeast	0.9x	0.77	x	6	x	50.42	x	0.45	x	0.7	=	66.04	(75)
Northeast	0.9x	0.77	x	3.24	x	28.07	x	0.45	x	0.7	=	19.85	(75)
Northeast	0.9x	0.77	x	6	x	28.07	x	0.45	x	0.7	=	36.76	(75)
Northeast	0.9x	0.77	x	3.24	x	14.2	x	0.45	x	0.7	=	10.04	(75)
Northeast	0.9x	0.77	x	6	x	14.2	x	0.45	x	0.7	=	18.59	(75)
Northeast	0.9x	0.77	x	3.24	x	9.21	x	0.45	x	0.7	=	6.52	(75)
Northeast	0.9x	0.77	x	6	x	9.21	x	0.45	x	0.7	=	12.07	(75)
Northwest	0.9x	0.77	x	1.46	x	11.28	x	0.45	x	0.7	=	3.6	(81)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	1.46	x	22.97	x	0.45	x	0.7	=	7.32	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	1.46	x	41.38	x	0.45	x	0.7	=	13.19	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	1.46	x	67.96	x	0.45	x	0.7	=	21.66	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	1.46	x	91.35	x	0.45	x	0.7	=	29.11	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest	0.9x	0.77	x	1.46	x	97.38	x	0.45	x	0.7	=	31.04	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	1.46	x	91.1	x	0.45	x	0.7	=	29.03	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	1.46	x	72.63	x	0.45	x	0.7	=	23.15	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	1.46	x	50.42	x	0.45	x	0.7	=	16.07	(81)

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Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	1.46	x	28.07	x	0.45	x	0.7	=	8.95	(81)
Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest	0.9x	0.77	x	1.46	x	14.2	x	0.45	x	0.7	=	4.52	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	1.46	x	9.21	x	0.45	x	0.7	=	2.94	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)

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

(83)m=	32.34	65.83	118.6	194.78	261.82	279.12	261.12	208.16	144.52	80.45	40.69	26.41	(83)

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

(84)m=	355.21	387.04	430.2	491	542.7	544.98	517.05	468.88	412.99	364.47	342.57	341.42	(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=	0.95	0.93	0.9	0.81	0.68	0.52	0.4	0.45	0.67	0.85	0.93	0.95	(86)

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

(87)m=	19.08	19.29	19.69	20.22	20.64	20.88	20.96	20.94	20.75	20.22	19.58	19.04	(87)

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

(88)m=	20.07	20.07	20.07	20.09	20.09	20.1	20.1	20.1	20.1	20.09	20.08	20.08	(88)

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

(89)m=	0.94	0.92	0.88	0.79	0.64	0.46	0.32	0.37	0.61	0.83	0.92	0.95	(89)

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

(90)m=	17.5	17.8	18.38	19.13	19.69	19.99	20.07	20.06	19.85	19.14	18.23	17.46	(90)

fLA = Living area ÷ (4) = 0.43 (91)

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

(92)m=	18.18	18.44	18.94	19.6	20.1	20.38	20.45	20.44	20.24	19.61	18.81	18.14	(92)

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

(93)m=	18.18	18.44	18.94	19.6	20.1	20.38	20.45	20.44	20.24	19.61	18.81	18.14	(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=	0.92	0.9	0.86	0.77	0.64	0.48	0.35	0.4	0.62	0.81	0.9	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	327.94	349.65	370.05	378.88	346.82	261.36	182.63	188.17	255.85	296.19	307.45	317.35	(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=	707.84	688.75	631.02	535.04	418.82	283.75	189.35	197.92	303.3	448.99	587.02	702.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	282.64	227.88	194.17	112.44	53.57	0	0	0	0	113.68	201.29	286.84	

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	Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ =	1472.49	(98)
Space heating requirement in kWh/m²/year		29.37	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1472.49	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1766.99	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1822.04	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2186.44	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	39.53	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		113.47	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	113.47	(331)
Energy for lighting (calculated in Appendix L)		232.38	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3569.22	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	986.46	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.52	(372)

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Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1006.98	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1006.98	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	58.89	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	120.61	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =			807.57	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.11	(384)
EI rating (section 14)				88.63	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.5.49

Property Address: Block N - Mid Floor

Address : N, Block N, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.14	(1a) x	2.5	(2a) =	125.35	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.14	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	125.35	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			1.46	x1/[1/(1.2)+ 0.04]		=	1.67			(27)
Windows Type 2			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 3			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 4			6	x1/[1/(1.2)+ 0.04]		=	6.87			(27)
Walls Type1	42.2	13.13	29.07	x	0.16	=	4.65			(29)
Walls Type2	22.4	1.91	20.49	x	0.15	=	3.08			(29)
Total area of elements, m²			64.6							(31)
Party wall			10.45	x	0	=	0			(32)
Party floor			50.14							(32a)
Party ceiling			50.14							(32b)

** 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) = 24.68 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4426.09 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 6.07 (36)

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

Total fabric heat loss (33) + (36) = 30.75 (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=	12.24	12.1	11.95	11.23	11.09	10.36	10.36	10.22	10.65	11.09	11.38	11.67	(38)

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

(39)m=	42.99	42.85	42.7	41.98	41.83	41.11	41.11	40.97	41.4	41.83	42.12	42.41	

Average = Sum(39)$_{1…12}$ /12= 41.94 (39)

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

(40)m=	0.86	0.85	0.85	0.84	0.83	0.82	0.82	0.82	0.83	0.83	0.84	0.85	

Average = Sum(40)$_{1…12}$ /12= 0.84 (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 1.69 (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 74.44 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	81.88	78.9	75.93	72.95	69.97	66.99	66.99	69.97	72.95	75.93	78.9	81.88	

Total = Sum(44)$_{1…12}$ = 893.25 (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=	121.43	106.2	109.59	95.54	91.68	79.11	73.31	84.12	85.13	99.21	108.29	117.6	

Total = Sum(45)$_{1…12}$ = 1171.2 (45)

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

(46)m=	18.21	15.93	16.44	14.33	13.75	11.87	11	12.62	12.77	14.88	16.24	17.64	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	176.7	156.13	164.87	149.04	146.95	132.6	128.58	139.4	138.62	154.48	161.78	172.87	(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=	176.7	156.13	164.87	149.04	146.95	132.6	128.58	139.4	138.62	154.48	161.78	172.87

Output from water heater (annual)$_{1…12}$ — 1822.04 (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=	84.6	75.25	80.66	74.56	74.7	69.1	68.6	72.19	71.1	77.21	78.8	83.32	(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=	84.71	84.71	84.71	84.71	84.71	84.71	84.71	84.71	84.71	84.71	84.71	84.71	(66)

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

(67)m=	13.16	11.69	9.5	7.2	5.38	4.54	4.91	6.38	8.56	10.87	12.69	13.52	(67)

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

(68)m=	147.6	149.13	145.27	137.05	126.68	116.93	110.42	108.89	112.75	120.96	131.34	141.09	(68)

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

(69)m=	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	(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=	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	-67.77	(71)

Water heating gains (Table 5)

(72)m=	113.7	111.99	108.41	103.56	100.41	95.97	92.2	97.03	98.75	103.77	109.45	111.99	(72)

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

(73)m=	322.87	321.21	311.6	296.22	280.88	265.86	255.94	260.71	268.47	284.02	301.88	315.01	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

Northeast	0.9x	0.77	x	3.24	x	11.28	x	0.45	x	0.7	=	7.98	(75)
Northeast	0.9x	0.77	x	6	x	11.28	x	0.45	x	0.7	=	14.78	(75)
Northeast	0.9x	0.77	x	3.24	x	22.97	x	0.45	x	0.7	=	16.24	(75)
Northeast	0.9x	0.77	x	6	x	22.97	x	0.45	x	0.7	=	30.08	(75)
Northeast	0.9x	0.77	x	3.24	x	41.38	x	0.45	x	0.7	=	29.27	(75)
Northeast	0.9x	0.77	x	6	x	41.38	x	0.45	x	0.7	=	54.2	(75)
Northeast	0.9x	0.77	x	3.24	x	67.96	x	0.45	x	0.7	=	48.06	(75)
Northeast	0.9x	0.77	x	6	x	67.96	x	0.45	x	0.7	=	89.01	(75)
Northeast	0.9x	0.77	x	3.24	x	91.35	x	0.45	x	0.7	=	64.61	(75)
Northeast	0.9x	0.77	x	6	x	91.35	x	0.45	x	0.7	=	119.64	(75)
Northeast	0.9x	0.77	x	3.24	x	97.38	x	0.45	x	0.7	=	68.88	(75)
Northeast	0.9x	0.77	x	6	x	97.38	x	0.45	x	0.7	=	127.55	(75)
Northeast	0.9x	0.77	x	3.24	x	91.1	x	0.45	x	0.7	=	64.43	(75)
Northeast	0.9x	0.77	x	6	x	91.1	x	0.45	x	0.7	=	119.32	(75)
Northeast	0.9x	0.77	x	3.24	x	72.63	x	0.45	x	0.7	=	51.37	(75)
Northeast	0.9x	0.77	x	6	x	72.63	x	0.45	x	0.7	=	95.12	(75)
Northeast	0.9x	0.77	x	3.24	x	50.42	x	0.45	x	0.7	=	35.66	(75)
Northeast	0.9x	0.77	x	6	x	50.42	x	0.45	x	0.7	=	66.04	(75)
Northeast	0.9x	0.77	x	3.24	x	28.07	x	0.45	x	0.7	=	19.85	(75)
Northeast	0.9x	0.77	x	6	x	28.07	x	0.45	x	0.7	=	36.76	(75)
Northeast	0.9x	0.77	x	3.24	x	14.2	x	0.45	x	0.7	=	10.04	(75)
Northeast	0.9x	0.77	x	6	x	14.2	x	0.45	x	0.7	=	18.59	(75)
Northeast	0.9x	0.77	x	3.24	x	9.21	x	0.45	x	0.7	=	6.52	(75)
Northeast	0.9x	0.77	x	6	x	9.21	x	0.45	x	0.7	=	12.07	(75)
Northwest	0.9x	0.77	x	1.46	x	11.28	x	0.45	x	0.7	=	3.6	(81)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	1.46	x	22.97	x	0.45	x	0.7	=	7.32	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	1.46	x	41.38	x	0.45	x	0.7	=	13.19	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	1.46	x	67.96	x	0.45	x	0.7	=	21.66	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	1.46	x	91.35	x	0.45	x	0.7	=	29.11	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest	0.9x	0.77	x	1.46	x	97.38	x	0.45	x	0.7	=	31.04	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	1.46	x	91.1	x	0.45	x	0.7	=	29.03	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	1.46	x	72.63	x	0.45	x	0.7	=	23.15	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	1.46	x	50.42	x	0.45	x	0.7	=	16.07	(81)

Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	1.46	x	28.07	x	0.45	x	0.7	=	8.95	(81)
Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest	0.9x	0.77	x	1.46	x	14.2	x	0.45	x	0.7	=	4.52	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	1.46	x	9.21	x	0.45	x	0.7	=	2.94	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)

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

(83)m=	32.34	65.83	118.6	194.78	261.82	279.12	261.12	208.16	144.52	80.45	40.69	26.41	(83)

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

(84)m=	355.21	387.04	430.2	491	542.7	544.98	517.05	468.88	412.99	364.47	342.57	341.42	(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=	0.94	0.92	0.88	0.78	0.62	0.46	0.34	0.39	0.61	0.83	0.92	0.95	(86)

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

(87)m=	19.48	19.68	20.04	20.49	20.8	20.95	20.98	20.98	20.86	20.46	19.92	19.45	(87)

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

(88)m=	20.2	20.21	20.21	20.22	20.22	20.24	20.24	20.24	20.23	20.22	20.22	20.21	(88)

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

(89)m=	0.94	0.91	0.86	0.75	0.59	0.41	0.29	0.33	0.56	0.8	0.91	0.94	(89)

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

(90)m=	18.16	18.45	18.96	19.59	20	20.19	20.23	20.22	20.1	19.57	18.8	18.13	(90)

fLA = Living area ÷ (4) = | 0.43 | (91)

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

(92)m=	18.73	18.98	19.42	19.98	20.34	20.51	20.55	20.55	20.43	19.95	19.28	18.7	(92)

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

(93)m=	18.73	18.98	19.42	19.98	20.34	20.51	20.55	20.55	20.43	19.95	19.28	18.7	(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=	0.92	0.9	0.85	0.74	0.59	0.43	0.31	0.35	0.57	0.79	0.89	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	326.29	346.66	363.65	364.09	321.77	233.06	159.85	165.84	236.31	287.71	304.38	316	(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=	620.3	603.16	551.87	465.12	361.6	243.08	162.43	169.82	261.88	391.35	513.06	614.79	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	218.74	172.37	140.03	72.74	29.64	0	0	0	0	77.11	150.25	222.3	(98)

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1083.18	(98)
Space heating requirement in kWh/m²/year		21.6	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1083.18	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1299.82	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1822.04	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2186.44	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	34.86	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		113.47	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	113.47	(331)
Energy for lighting (calculated in Appendix L)		232.38	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3102.04	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	869.89	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.09	(372)

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Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	887.98	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			887.98	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	58.89	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	120.61	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =			688.57	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.73	(384)
EI rating (section 14)				90.3	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block O - Ground Floor

Address : O, Block O, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.59	(1a) x	2.5	(2a) =	176.47	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.59	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.47	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

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

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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 2			2.61	x1/[1/(1.2)+ 0.04]		=	2.99			(27)
Windows Type 3			4.92	x1/[1/(1.2)+ 0.04]		=	5.63			(27)
Floor			70.59	x	0.1	=	7.059			(28)
Walls Type1	22.6	9.96	12.64	x	0.16	=	2.02			(29)
Walls Type2	22.6	1.91	20.69	x	0.15	=	3.11			(29)
Total area of elements, m²			115.79							(31)
Party wall			39.05	x	0	=	0			(32)
Party ceiling			70.59							(32b)

** 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) = 25.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11939.82 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 8.69 (36)

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

Total fabric heat loss (33) + (36) = 34.19 (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=	17.24	17.03	16.83	15.81	15.61	14.59	14.59	14.38	15	15.61	16.02	16.42	(38)

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

(39)m=	51.43	51.23	51.02	50	49.8	48.78	48.78	48.58	49.19	49.8	50.21	50.62	

Average = $Sum(39)_{1...12}$ /12= 49.95 (39)

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

(40)m=	0.73	0.73	0.72	0.71	0.71	0.69	0.69	0.69	0.7	0.71	0.71	0.72

Average = $Sum(40)_{1...12}$ /12= 0.71 (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 2.26 (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 87.88 (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=	96.67	93.16	89.64	86.13	82.61	79.1	79.1	82.61	86.13	89.64	93.16	96.67	

Total = $Sum(44)_{1...12}$ = 1054.6 (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=	143.36	125.39	129.39	112.8	108.24	93.4	86.55	99.32	100.5	117.13	127.85	138.84

Total = $Sum(45)_{1...12}$ = 1382.75 (45)

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

(46)m=	21.5	18.81	19.41	16.92	16.24	14.01	12.98	14.9	15.08	17.57	19.18	20.83	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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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=	198.64	175.31	184.66	166.3	163.51	146.89	141.83	154.59	154	172.4	181.34	194.12	(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=	198.64	175.31	184.66	166.3	163.51	146.89	141.83	154.59	154	172.4	181.34	194.12	

Output from water heater (annual)$_{1...12}$	2033.59	(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=	91.89	81.63	87.24	80.3	80.21	73.85	73	77.24	76.21	83.17	85.31	90.39	(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=	113.02	113.02	113.02	113.02	113.02	113.02	113.02	113.02	113.02	113.02	113.02	113.02	(66)

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

(67)m=	18.97	16.85	13.7	10.37	7.75	6.55	7.07	9.19	12.34	15.67	18.29	19.5	(67)

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

(68)m=	198.67	200.73	195.54	184.48	170.52	157.39	148.63	146.57	151.76	162.82	176.78	189.9	(68)

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

(69)m=	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	(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=	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	(71)

Water heating gains (Table 5)

(72)m=	123.51	121.48	117.26	111.53	107.81	102.57	98.12	103.82	105.85	111.78	118.48	121.49	(72)

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

(73)m=	398.05	395.96	383.41	363.29	342.98	323.42	310.72	316.49	326.86	347.18	370.46	387.79	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(75)
Northeast 0.9x	0.77	x	2.61	x	11.28	x	0.45	x	0.7	=	6.43	(75)

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Northeast	0.9x	0.77	x	4.92	x	11.28	x	0.45	x	0.7	=	12.12	(75)
Northeast	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(75)
Northeast	0.9x	0.77	x	2.61	x	22.97	x	0.45	x	0.7	=	13.09	(75)
Northeast	0.9x	0.77	x	4.92	x	22.97	x	0.45	x	0.7	=	24.67	(75)
Northeast	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(75)
Northeast	0.9x	0.77	x	2.61	x	41.38	x	0.45	x	0.7	=	23.58	(75)
Northeast	0.9x	0.77	x	4.92	x	41.38	x	0.45	x	0.7	=	44.44	(75)
Northeast	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(75)
Northeast	0.9x	0.77	x	2.61	x	67.96	x	0.45	x	0.7	=	38.72	(75)
Northeast	0.9x	0.77	x	4.92	x	67.96	x	0.45	x	0.7	=	72.99	(75)
Northeast	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(75)
Northeast	0.9x	0.77	x	2.61	x	91.35	x	0.45	x	0.7	=	52.04	(75)
Northeast	0.9x	0.77	x	4.92	x	91.35	x	0.45	x	0.7	=	98.11	(75)
Northeast	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(75)
Northeast	0.9x	0.77	x	2.61	x	97.38	x	0.45	x	0.7	=	55.48	(75)
Northeast	0.9x	0.77	x	4.92	x	97.38	x	0.45	x	0.7	=	104.59	(75)
Northeast	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(75)
Northeast	0.9x	0.77	x	2.61	x	91.1	x	0.45	x	0.7	=	51.9	(75)
Northeast	0.9x	0.77	x	4.92	x	91.1	x	0.45	x	0.7	=	97.84	(75)
Northeast	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(75)
Northeast	0.9x	0.77	x	2.61	x	72.63	x	0.45	x	0.7	=	41.38	(75)
Northeast	0.9x	0.77	x	4.92	x	72.63	x	0.45	x	0.7	=	78	(75)
Northeast	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(75)
Northeast	0.9x	0.77	x	2.61	x	50.42	x	0.45	x	0.7	=	28.73	(75)
Northeast	0.9x	0.77	x	4.92	x	50.42	x	0.45	x	0.7	=	54.15	(75)
Northeast	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(75)
Northeast	0.9x	0.77	x	2.61	x	28.07	x	0.45	x	0.7	=	15.99	(75)
Northeast	0.9x	0.77	x	4.92	x	28.07	x	0.45	x	0.7	=	30.14	(75)
Northeast	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(75)
Northeast	0.9x	0.77	x	2.61	x	14.2	x	0.45	x	0.7	=	8.09	(75)
Northeast	0.9x	0.77	x	4.92	x	14.2	x	0.45	x	0.7	=	15.25	(75)
Northeast	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(75)
Northeast	0.9x	0.77	x	2.61	x	9.21	x	0.45	x	0.7	=	5.25	(75)
Northeast	0.9x	0.77	x	4.92	x	9.21	x	0.45	x	0.7	=	9.9	(75)

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

(83)m=	24.53	49.93	89.97	147.75	198.61	211.74	198.07	157.91	109.63	61.02	30.87	20.03	(83)

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

(84)m=	422.58	445.9	473.37	511.04	541.59	535.15	508.8	474.4	436.48	408.2	401.32	407.83	(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

DER WorkSheet: New dwelling design stage

(86)m=	0.96	0.94	0.92	0.84	0.72	0.55	0.41	0.46	0.68	0.87	0.94	0.96	(86)

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

(87)m=	19.65	19.8	20.09	20.48	20.78	20.94	20.98	20.98	20.87	20.51	20.04	19.64	(87)

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

(88)m=	20.32	20.32	20.32	20.33	20.34	20.35	20.35	20.35	20.34	20.34	20.33	20.33	(88)

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

(89)m=	0.95	0.94	0.91	0.82	0.69	0.5	0.35	0.4	0.63	0.85	0.93	0.96	(89)

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

(90)m=	18.49	18.7	19.12	19.68	20.08	20.29	20.34	20.33	20.21	19.72	19.06	18.47	(90)

fLA = Living area ÷ (4) = 0.38 (91)

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

(92)m=	18.93	19.12	19.48	19.98	20.34	20.54	20.58	20.58	20.46	20.02	19.43	18.91	(92)

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

(93)m=	18.93	19.12	19.48	19.98	20.34	20.54	20.58	20.58	20.46	20.02	19.43	18.91	(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=	0.94	0.92	0.89	0.81	0.69	0.51	0.37	0.42	0.64	0.83	0.91	0.94	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	396.67	412	421.33	415.86	371.73	274.89	190.69	197.72	279.46	340.72	367.04	385.03	(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=	752.25	728.38	662.48	554.04	430.44	289.59	194.19	202.87	312.66	469.11	618.92	744.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	264.55	212.6	179.42	99.49	43.68	0	0	0	0	95.52	181.35	267.41	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1344.03 (98)

Space heating requirement in kWh/m²/year 19.04 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump 1 (303a)

Fraction of total space heat from Community heat pump (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.2 (306)

Space heating **kWh/year**

Annual space heating requirement 1344.03

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1612.83	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2033.59	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2440.31	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.53	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		134.56	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	134.56	(331)
Energy for lighting (calculated in Appendix L)		335	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3792.63	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1011.34	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.04	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1032.37	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1032.37	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	69.84	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	173.87	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				897.17	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				12.71	(384)
EI rating (section 14)					89.6	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block O - Mid Floor

Address : O, Block O, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.59	(1a) x	2.5	(2a) =	176.47	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.59	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.47	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 2			2.61	x1/[1/(1.2)+ 0.04]		=	2.99			(27)
Windows Type 3			4.92	x1/[1/(1.2)+ 0.04]		=	5.63			(27)
Walls Type1	22.6	9.96	12.64	x	0.16	=	2.02			(29)
Walls Type2	22.6	1.91	20.69	x	0.15	=	3.11			(29)
Total area of elements, m²			45.2							(31)
Party wall			39.05	x	0	=	0			(32)
Party floor			70.59							(32a)
Party ceiling			70.59							(32b)

** 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) = 18.45 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6998.52 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 4.56 (36)

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

Total fabric heat loss (33) + (36) = 23.01 (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

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(38)m=	17.24	17.03	16.83	15.81	15.61	14.59	14.59	14.38	15	15.61	16.02	16.42	(38)

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

(39)m=	40.25	40.04	39.84	38.82	38.61	37.6	37.6	37.39	38	38.61	39.02	39.43	

Average = Sum(39)$_{1...12}$ /12= 38.77 (39)

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

(40)m=	0.57	0.57	0.56	0.55	0.55	0.53	0.53	0.53	0.54	0.55	0.55	0.56

Average = Sum(40)$_{1...12}$ /12= 0.55 (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 2.26 (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 87.88 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	96.67	93.16	89.64	86.13	82.61	79.1	79.1	82.61	86.13	89.64	93.16	96.67

Total = Sum(44)$_{1...12}$ = 1054.6 (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=	143.36	125.39	129.39	112.8	108.24	93.4	86.55	99.32	100.5	117.13	127.85	138.84

Total = Sum(45)$_{1...12}$ = 1382.75 (45)

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

(46)m=	21.5	18.81	19.41	16.92	16.24	14.01	12.98	14.9	15.08	17.57	19.18	20.83	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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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=	198.64	175.31	184.66	166.3	163.51	146.89	141.83	154.59	154	172.4	181.34	194.12	(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=	198.64	175.31	184.66	166.3	163.51	146.89	141.83	154.59	154	172.4	181.34	194.12

Output from water heater (annual)1…12 | 2033.59 | (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=	91.89	81.63	87.24	80.3	80.21	73.85	73	77.24	76.21	83.17	85.31	90.39	(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=	113.02	113.02	113.02	113.02	113.02	113.02	113.02	113.02	113.02	113.02	113.02	113.02	(66)

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

(67)m=	18.97	16.85	13.7	10.37	7.75	6.55	7.07	9.19	12.34	15.67	18.29	19.5	(67)

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

(68)m=	198.67	200.73	195.54	184.48	170.52	157.39	148.63	146.57	151.76	162.82	176.78	189.9	(68)

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

(69)m=	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	(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=	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	-90.41	(71)

Water heating gains (Table 5)

(72)m=	123.51	121.48	117.26	111.53	107.81	102.57	98.12	103.82	105.85	111.78	118.48	121.49	(72)

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

(73)m=	398.05	395.96	383.41	363.29	342.98	323.42	310.72	316.49	326.86	347.18	370.46	387.79	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(75)
Northeast	0.9x	0.77	x	2.61	x	11.28	x	0.45	x	0.7	=	6.43	(75)

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Northeast 0.9x	0.77	x	4.92	x	11.28	x	0.45	x	0.7	=	12.12	(75)
Northeast 0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(75)
Northeast 0.9x	0.77	x	2.61	x	22.97	x	0.45	x	0.7	=	13.09	(75)
Northeast 0.9x	0.77	x	4.92	x	22.97	x	0.45	x	0.7	=	24.67	(75)
Northeast 0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(75)
Northeast 0.9x	0.77	x	2.61	x	41.38	x	0.45	x	0.7	=	23.58	(75)
Northeast 0.9x	0.77	x	4.92	x	41.38	x	0.45	x	0.7	=	44.44	(75)
Northeast 0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(75)
Northeast 0.9x	0.77	x	2.61	x	67.96	x	0.45	x	0.7	=	38.72	(75)
Northeast 0.9x	0.77	x	4.92	x	67.96	x	0.45	x	0.7	=	72.99	(75)
Northeast 0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(75)
Northeast 0.9x	0.77	x	2.61	x	91.35	x	0.45	x	0.7	=	52.04	(75)
Northeast 0.9x	0.77	x	4.92	x	91.35	x	0.45	x	0.7	=	98.11	(75)
Northeast 0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(75)
Northeast 0.9x	0.77	x	2.61	x	97.38	x	0.45	x	0.7	=	55.48	(75)
Northeast 0.9x	0.77	x	4.92	x	97.38	x	0.45	x	0.7	=	104.59	(75)
Northeast 0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(75)
Northeast 0.9x	0.77	x	2.61	x	91.1	x	0.45	x	0.7	=	51.9	(75)
Northeast 0.9x	0.77	x	4.92	x	91.1	x	0.45	x	0.7	=	97.84	(75)
Northeast 0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(75)
Northeast 0.9x	0.77	x	2.61	x	72.63	x	0.45	x	0.7	=	41.38	(75)
Northeast 0.9x	0.77	x	4.92	x	72.63	x	0.45	x	0.7	=	78	(75)
Northeast 0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(75)
Northeast 0.9x	0.77	x	2.61	x	50.42	x	0.45	x	0.7	=	28.73	(75)
Northeast 0.9x	0.77	x	4.92	x	50.42	x	0.45	x	0.7	=	54.15	(75)
Northeast 0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(75)
Northeast 0.9x	0.77	x	2.61	x	28.07	x	0.45	x	0.7	=	15.99	(75)
Northeast 0.9x	0.77	x	4.92	x	28.07	x	0.45	x	0.7	=	30.14	(75)
Northeast 0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(75)
Northeast 0.9x	0.77	x	2.61	x	14.2	x	0.45	x	0.7	=	8.09	(75)
Northeast 0.9x	0.77	x	4.92	x	14.2	x	0.45	x	0.7	=	15.25	(75)
Northeast 0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(75)
Northeast 0.9x	0.77	x	2.61	x	9.21	x	0.45	x	0.7	=	5.25	(75)
Northeast 0.9x	0.77	x	4.92	x	9.21	x	0.45	x	0.7	=	9.9	(75)

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

(83)m=	24.53	49.93	89.97	147.75	198.61	211.74	198.07	157.91	109.63	61.02	30.87	20.03	(83)

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

(84)m=	422.58	445.9	473.37	511.04	541.59	535.15	508.8	474.4	436.48	408.2	401.32	407.83	(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

DER WorkSheet: New dwelling design stage

(86)m=	0.94	0.93	0.88	0.78	0.62	0.44	0.32	0.36	0.57	0.81	0.91	0.95	(86)

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

(87)m=	20.13	20.26	20.49	20.77	20.93	20.99	21	21	20.96	20.77	20.44	20.12	(87)

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

(88)m=	20.46	20.46	20.46	20.48	20.48	20.49	20.49	20.49	20.49	20.48	20.47	20.47	(88)

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

(89)m=	0.94	0.92	0.87	0.76	0.59	0.41	0.29	0.32	0.54	0.79	0.9	0.94	(89)

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

(90)m=	19.28	19.47	19.79	20.19	20.4	20.48	20.49	20.49	20.45	20.19	19.73	19.27	(90)

fLA = Living area ÷ (4) = 0.38 (91)

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

(92)m=	19.6	19.77	20.05	20.41	20.6	20.67	20.68	20.68	20.64	20.41	19.99	19.59	(92)

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

(93)m=	19.6	19.77	20.05	20.41	20.6	20.67	20.68	20.68	20.64	20.41	19.99	19.59	(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=	0.93	0.91	0.86	0.76	0.6	0.42	0.3	0.34	0.55	0.78	0.89	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	391.49	404.15	407.05	385.91	324.86	225.34	152.93	159.29	239.37	319.5	358.05	380.45	(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=	615.79	595.3	539.99	446.63	343.53	228.25	153.43	160.09	248.59	378.85	503.18	606.91	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	166.88	128.46	98.9	43.72	13.89	0	0	0	0	44.15	104.49	168.49	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 768.98 (98)

Space heating requirement in kWh/m²/year 10.89 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump 1 (303a)

Fraction of total space heat from Community heat pump (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.2 (306)

Space heating	**kWh/year**
Annual space heating requirement	768.98

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	922.78	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2033.59	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2440.31	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	33.63	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		134.56	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	134.56	(331)
Energy for lighting (calculated in Appendix L)		335	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3102.58	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	839.15	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	17.45	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	856.61	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				856.61	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	69.84	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	173.87	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				721.4	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				10.22	(384)
EI rating (section 14)					91.64	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.49

Property Address: Block R - Ground Floor

Address : R, Block R, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	58.65	(1a) x	2.5	(2a) =	146.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	58.65	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		146.63	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

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

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)

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]

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(24a)
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)
(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 2			2.52	x1/[1/(1.2)+ 0.04]		=	2.89			(27)
Windows Type 3			7.56	x1/[1/(1.2)+ 0.04]		=	8.66			(27)
Windows Type 4			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 5			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Floor			58.65	x	0.1	=	5.865			(28)
Walls Type1	41.08	18.18	22.9	x	0.16	=	3.66			(29)
Walls Type2	29.12	1.91	27.22	x	0.15	=	4.09			(29)
Total area of elements, m²			128.85							(31)
Party wall			12.02	x	0	=	0			(32)
Party ceiling			58.65							(32b)

** 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) =	36.35	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	9203.12	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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	10.27	(36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 46.62 (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=	14.32	14.15	13.98	13.14	12.97	12.12	12.12	11.95	12.46	12.97	13.31	13.64	(38)

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

(39)m=	60.94	60.77	60.6	59.75	59.59	58.74	58.74	58.57	59.08	59.59	59.92	60.26	

Average = Sum(39)$_{1\ldots12}$ /12= 59.71 (39)

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

(40)m=	1.04	1.04	1.03	1.02	1.02	1	1	1	1.01	1.02	1.02	1.03	

Average = Sum(40)$_{1\ldots12}$ /12= 1.02 (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 1.94 (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 80.35 (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=	88.39	85.17	81.96	78.74	75.53	72.32	72.32	75.53	78.74	81.96	85.17	88.39	

Total = Sum(44)$_{1\ldots12}$ = 964.22 (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=	131.07	114.64	118.3	103.13	98.96	85.39	79.13	90.8	91.89	107.09	116.89	126.94	

Total = Sum(45)$_{1\ldots12}$ = 1264.24 (45)

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

(46)m=	19.66	17.2	17.74	15.47	14.84	12.81	11.87	13.62	13.78	16.06	17.53	19.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	186.35	164.57	173.57	156.63	154.24	138.89	134.41	146.08	145.38	162.36	170.39	182.22	(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=	186.35	164.57	173.57	156.63	154.24	138.89	134.41	146.08	145.38	162.36	170.39	182.22	

Output from water heater (annual)$_{1...12}$ 1915.08 (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=	87.8	78.06	83.56	77.09	77.13	71.19	70.53	74.41	73.35	79.83	81.66	86.43	(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=	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	(66)

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

(67)m=	15.11	13.42	10.92	8.26	6.18	5.22	5.64	7.33	9.83	12.48	14.57	15.53	(67)

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

(68)m=	169.53	171.29	166.86	157.42	145.51	134.31	126.83	125.07	129.5	138.94	150.85	162.05	(68)

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

(69)m=	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	(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=	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	(71)

Water heating gains (Table 5)

(72)m=	118.02	116.16	112.31	107.07	103.66	98.87	94.8	100.02	101.87	107.3	113.42	116.17	(72)

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

(73)m=	354.81	353.02	342.23	324.9	307.49	290.55	279.41	284.56	293.35	310.87	330.99	345.9	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest	0.9x	0.77	x	3.24	x	36.79		0.45	x	0.7	=	26.02	(79)
Southwest	0.9x	0.77	x	2.52	x	36.79		0.45	x	0.7	=	20.24	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.45	x	0.7	=	44.33	(79)
Southwest	0.9x	0.77	x	2.52	x	62.67		0.45	x	0.7	=	34.48	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.45	x	0.7	=	60.65	(79)
Southwest	0.9x	0.77	x	2.52	x	85.75		0.45	x	0.7	=	47.17	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.45	x	0.7	=	75.15	(79)
Southwest	0.9x	0.77	x	2.52	x	106.25		0.45	x	0.7	=	58.45	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.45	x	0.7	=	84.17	(79)
Southwest	0.9x	0.77	x	2.52	x	119.01		0.45	x	0.7	=	65.47	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.45	x	0.7	=	83.56	(79)
Southwest	0.9x	0.77	x	2.52	x	118.15		0.45	x	0.7	=	64.99	(79)
Southwest	0.9x	0.77	x	3.24	x	113.91		0.45	x	0.7	=	80.57	(79)
Southwest	0.9x	0.77	x	2.52	x	113.91		0.45	x	0.7	=	62.66	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.45	x	0.7	=	73.83	(79)
Southwest	0.9x	0.77	x	2.52	x	104.39		0.45	x	0.7	=	57.43	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.45	x	0.7	=	65.67	(79)
Southwest	0.9x	0.77	x	2.52	x	92.85		0.45	x	0.7	=	51.08	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.45	x	0.7	=	48.99	(79)
Southwest	0.9x	0.77	x	2.52	x	69.27		0.45	x	0.7	=	38.1	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.45	x	0.7	=	31.17	(79)
Southwest	0.9x	0.77	x	2.52	x	44.07		0.45	x	0.7	=	24.24	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.45	x	0.7	=	22.27	(79)
Southwest	0.9x	0.77	x	2.52	x	31.49		0.45	x	0.7	=	17.32	(79)
Northwest	0.9x	0.77	x	7.56	x	11.28	x	0.45	x	0.7	=	18.62	(81)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	7.56	x	22.97	x	0.45	x	0.7	=	37.9	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	7.56	x	41.38	x	0.45	x	0.7	=	68.29	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	7.56	x	67.96	x	0.45	x	0.7	=	112.15	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	7.56	x	91.35	x	0.45	x	0.7	=	150.75	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)

Northwest	0.9x	0.77	x	7.56	x	97.38	x	0.45	x	0.7	=	160.71	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	7.56	x	91.1	x	0.45	x	0.7	=	150.35	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	7.56	x	72.63	x	0.45	x	0.7	=	119.86	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	7.56	x	50.42	x	0.45	x	0.7	=	83.21	(81)
Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	7.56	x	28.07	x	0.45	x	0.7	=	46.32	(81)
Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest	0.9x	0.77	x	7.56	x	14.2	x	0.45	x	0.7	=	23.43	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	7.56	x	9.21	x	0.45	x	0.7	=	15.21	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)

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

(83)m=	76.85	141.07	220.01	317.84	397.3	412.59	390.22	328.17	253.45	163.19	93.9	64.57	(83)

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

(84)m=	431.66	494.09	562.24	642.74	704.8	703.14	669.64	612.73	546.81	474.06	424.9	410.47	(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=	0.94	0.92	0.87	0.78	0.64	0.49	0.37	0.42	0.62	0.83	0.92	0.95	(86)

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

(87)m=	19.07	19.34	19.77	20.29	20.68	20.9	20.97	20.95	20.79	20.27	19.59	19.02	(87)

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

(88)m=	20.05	20.05	20.06	20.07	20.07	20.08	20.08	20.08	20.08	20.07	20.07	20.06	(88)

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

(89)m=	0.94	0.91	0.86	0.75	0.6	0.43	0.3	0.34	0.56	0.8	0.91	0.94	(89)

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

(90)m=	17.47	17.86	18.48	19.21	19.72	19.99	20.06	20.05	19.87	19.2	18.24	17.41	(90)

fLA = Living area ÷ (4) = | 0.42 | (91)

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

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(92)m=	18.14	18.48	19.02	19.66	20.12	20.37	20.44	20.43	20.25	19.65	18.81	18.09	(92)

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

(93)m=	18.14	18.48	19.02	19.66	20.12	20.37	20.44	20.43	20.25	19.65	18.81	18.09	(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=	0.92	0.89	0.83	0.74	0.6	0.45	0.33	0.37	0.58	0.78	0.89	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	396.18	438.72	469.36	474.52	425.67	315.56	218.7	226.19	315.22	371.67	376.9	380.04	(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=	843.64	825.47	758.63	643.12	501.9	338.91	225.53	235.96	363.56	539.38	701.5	836.96	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	332.92	259.9	215.21	121.39	56.72	0	0	0	0	124.77	233.71	339.95	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1684.57 (98)

Space heating requirement in kWh/m²/year 28.72 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1684.57	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2021.48	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1915.08	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2298.1	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.2	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

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Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		111.8	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	111.8	(331)
Energy for lighting (calculated in Appendix L)		266.91	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3968.22	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1077.82	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.42	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1100.24	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1100.24	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	58.03	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	138.53	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				917.88	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.65	(384)
EI rating (section 14)					88.13	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block R - Mid Floor

Address : R, Block R, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	58.65	(1a) x	2.5	(2a) =	146.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	58.65	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	146.63	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 2			2.52	x1/[1/(1.2)+ 0.04]		=	2.89			(27)
Windows Type 3			7.56	x1/[1/(1.2)+ 0.04]		=	8.66			(27)
Windows Type 4			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 5			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Walls Type1	41.08	18.18	22.9	x	0.16	=	3.66			(29)
Walls Type2	29.12	1.91	27.22	x	0.15	=	4.09			(29)
Total area of elements, m²			70.2							(31)
Party wall			12.02	x	0	=	0			(32)
Party floor			58.65							(32a)
Party ceiling			58.65							(32b)

** 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) = 30.48 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 5097.62 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 6.97 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 37.45 (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=	14.32	14.15	13.98	13.14	12.97	12.12	12.12	11.95	12.46	12.97	13.31	13.64	(38)

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

(39)m=	51.78	51.61	51.44	50.59	50.42	49.57	49.57	49.41	49.91	50.42	50.76	51.1	

Average = Sum(39)$_{1…12}$ /12= 50.55 (39)

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

(40)m=	0.88	0.88	0.88	0.86	0.86	0.85	0.85	0.84	0.85	0.86	0.87	0.87	

Average = Sum(40)$_{1…12}$ /12= 0.86 (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 1.94 (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 80.35 (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=	88.39	85.17	81.96	78.74	75.53	72.32	72.32	75.53	78.74	81.96	85.17	88.39	

Total = Sum(44)$_{1…12}$ = 964.22 (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=	131.07	114.64	118.3	103.13	98.96	85.39	79.13	90.8	91.89	107.09	116.89	126.94	

Total = Sum(45)$_{1…12}$ = 1264.24 (45)

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

(46)m=	19.66	17.2	17.74	15.47	14.84	12.81	11.87	13.62	13.78	16.06	17.53	19.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	186.35	164.57	173.57	156.63	154.24	138.89	134.41	146.08	145.38	162.36	170.39	182.22	(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=	186.35	164.57	173.57	156.63	154.24	138.89	134.41	146.08	145.38	162.36	170.39	182.22	

Output from water heater (annual)1…12 | 1915.08 | (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=	87.8	78.06	83.56	77.09	77.13	71.19	70.53	74.41	73.35	79.83	81.66	86.43	(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=	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	(66)

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

(67)m=	15.11	13.42	10.92	8.26	6.18	5.22	5.64	7.33	9.83	12.48	14.57	15.53	(67)

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

(68)m=	169.53	171.29	166.86	157.42	145.51	134.31	126.83	125.07	129.5	138.94	150.85	162.05	(68)

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

(69)m=	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	(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=	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	(71)

Water heating gains (Table 5)

(72)m=	118.02	116.16	112.31	107.07	103.66	98.87	94.8	100.02	101.87	107.3	113.42	116.17	(72)

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

(73)m=	354.81	353.02	342.23	324.9	307.49	290.55	279.41	284.56	293.35	310.87	330.99	345.9	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest	0.9x	0.77	x	3.24	x	36.79		0.45	x	0.7	=	26.02	(79)
Southwest	0.9x	0.77	x	2.52	x	36.79		0.45	x	0.7	=	20.24	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.45	x	0.7	=	44.33	(79)
Southwest	0.9x	0.77	x	2.52	x	62.67		0.45	x	0.7	=	34.48	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.45	x	0.7	=	60.65	(79)
Southwest	0.9x	0.77	x	2.52	x	85.75		0.45	x	0.7	=	47.17	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.45	x	0.7	=	75.15	(79)
Southwest	0.9x	0.77	x	2.52	x	106.25		0.45	x	0.7	=	58.45	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.45	x	0.7	=	84.17	(79)
Southwest	0.9x	0.77	x	2.52	x	119.01		0.45	x	0.7	=	65.47	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.45	x	0.7	=	83.56	(79)
Southwest	0.9x	0.77	x	2.52	x	118.15		0.45	x	0.7	=	64.99	(79)
Southwest	0.9x	0.77	x	3.24	x	113.91		0.45	x	0.7	=	80.57	(79)
Southwest	0.9x	0.77	x	2.52	x	113.91		0.45	x	0.7	=	62.66	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.45	x	0.7	=	73.83	(79)
Southwest	0.9x	0.77	x	2.52	x	104.39		0.45	x	0.7	=	57.43	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.45	x	0.7	=	65.67	(79)
Southwest	0.9x	0.77	x	2.52	x	92.85		0.45	x	0.7	=	51.08	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.45	x	0.7	=	48.99	(79)
Southwest	0.9x	0.77	x	2.52	x	69.27		0.45	x	0.7	=	38.1	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.45	x	0.7	=	31.17	(79)
Southwest	0.9x	0.77	x	2.52	x	44.07		0.45	x	0.7	=	24.24	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.45	x	0.7	=	22.27	(79)
Southwest	0.9x	0.77	x	2.52	x	31.49		0.45	x	0.7	=	17.32	(79)
Northwest	0.9x	0.77	x	7.56	x	11.28	x	0.45	x	0.7	=	18.62	(81)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	7.56	x	22.97	x	0.45	x	0.7	=	37.9	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	7.56	x	41.38	x	0.45	x	0.7	=	68.29	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	7.56	x	67.96	x	0.45	x	0.7	=	112.15	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	7.56	x	91.35	x	0.45	x	0.7	=	150.75	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)

Northwest	0.9x	0.77	x	7.56	x	97.38	x	0.45	x	0.7	=	160.71	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	7.56	x	91.1	x	0.45	x	0.7	=	150.35	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	7.56	x	72.63	x	0.45	x	0.7	=	119.86	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	7.56	x	50.42	x	0.45	x	0.7	=	83.21	(81)
Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	7.56	x	28.07	x	0.45	x	0.7	=	46.32	(81)
Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest	0.9x	0.77	x	7.56	x	14.2	x	0.45	x	0.7	=	23.43	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	7.56	x	9.21	x	0.45	x	0.7	=	15.21	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)

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

(83)m=	76.85	141.07	220.01	317.84	397.3	412.59	390.22	328.17	253.45	163.19	93.9	64.57	(83)

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

(84)m=	431.66	494.09	562.24	642.74	704.8	703.14	669.64	612.73	546.81	474.06	424.9	410.47	(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=	0.94	0.91	0.85	0.74	0.59	0.43	0.32	0.36	0.57	0.8	0.91	0.95	(86)

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

(87)m=	19.46	19.72	20.1	20.54	20.82	20.95	20.99	20.98	20.88	20.5	19.92	19.41	(87)

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

(88)m=	20.18	20.18	20.19	20.2	20.2	20.21	20.21	20.22	20.21	20.2	20.2	20.19	(88)

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

(89)m=	0.93	0.9	0.83	0.71	0.55	0.38	0.26	0.3	0.52	0.77	0.9	0.94	(89)

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

(90)m=	18.11	18.48	19.03	19.64	20	20.17	20.2	20.2	20.09	19.6	18.79	18.06	(90)

fLA = Living area ÷ (4) = | 0.42 | (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	18.68	19	19.48	20.02	20.35	20.5	20.53	20.53	20.43	19.98	19.26	18.63	(92)

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

(93)m=	18.68	19	19.48	20.02	20.35	20.5	20.53	20.53	20.43	19.98	19.26	18.63	(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=	0.91	0.88	0.82	0.71	0.56	0.4	0.29	0.33	0.53	0.76	0.88	0.92	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	394.11	434.2	459.58	453.76	393.65	281.74	192.25	199.88	289.8	359.55	372.83	378.44	(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=	744.44	727.76	667.62	562.33	435.95	292.39	194.96	203.95	315.73	473.03	617.42	737.25	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	260.64	197.27	154.78	78.17	31.47	0	0	0	0	84.43	176.11	266.96	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1249.83	(98)
Space heating requirement in kWh/m²/year	21.31	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1249.83	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1499.8	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1915.08	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2298.1	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	37.98	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		111.8	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	111.8	(331)
Energy for lighting (calculated in Appendix L)		266.91	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3446.54	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	947.65	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.71	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	967.36	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				967.36	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	58.03	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	138.53	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				785	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				13.38	(384)
EI rating (section 14)					89.85	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block R - Top Floor

Address : R, Block R, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	58.65	(1a) x	2.5	(2a) =	146.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	58.65	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	146.63	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			3.24	x1/[1/(1.2)+ 0.04]		=	3.71			(27)
Windows Type 2			2.52	x1/[1/(1.2)+ 0.04]		=	2.89			(27)
Windows Type 3			7.56	x1/[1/(1.2)+ 0.04]		=	8.66			(27)
Windows Type 4			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 5			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Walls Type1	41.08	18.18	22.9	x	0.16	=	3.66			(29)
Walls Type2	29.12	1.91	27.22	x	0.15	=	4.09			(29)
Roof	58.65	0	58.65	x	0.1	=	5.87			(30)
Total area of elements, m²			128.85							(31)
Party wall			12.02	x	0	=	0			(32)
Party floor			58.65							(32a)

** 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) = 36.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3865.97 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 20.9 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss	(33) + (36) =	57.25	(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=	14.32	14.15	13.98	13.14	12.97	12.12	12.12	11.95	12.46	12.97	13.31	13.64	(38)

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

(39)m=	71.57	71.4	71.23	70.38	70.21	69.37	69.37	69.2	69.71	70.21	70.55	70.89	

Average = Sum(39)$_{1\ldots12}$ /12= 70.34 (39)

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

(40)m=	1.22	1.22	1.21	1.2	1.2	1.18	1.18	1.18	1.19	1.2	1.2	1.21	

Average = Sum(40)$_{1\ldots12}$ /12= 1.2 (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 1.94 (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 80.35 (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=	88.39	85.17	81.96	78.74	75.53	72.32	72.32	75.53	78.74	81.96	85.17	88.39	

Total = Sum(44)$_{1\ldots12}$ = 964.22 (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=	131.07	114.64	118.3	103.13	98.96	85.39	79.13	90.8	91.89	107.09	116.89	126.94	

Total = Sum(45)$_{1\ldots12}$ = 1264.24 (45)

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

(46)m=	19.66	17.2	17.74	15.47	14.84	12.81	11.87	13.62	13.78	16.06	17.53	19.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		0	(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) =	110	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02	(51)
If community heating see section 4.3			
Volume factor from Table 2a		1.03	(52)
Temperature factor from Table 2b		0.6	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.03	(54)
Enter (50) or (54) in (55)		1.03	(55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	186.35	164.57	173.57	156.63	154.24	138.89	134.41	146.08	145.38	162.36	170.39	182.22	(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=	186.35	164.57	173.57	156.63	154.24	138.89	134.41	146.08	145.38	162.36	170.39	182.22

Output from water heater (annual)$_{1...12}$ 1915.08 (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=	87.8	78.06	83.56	77.09	77.13	71.19	70.53	74.41	73.35	79.83	81.66	86.43	(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=	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	97.16	(66)

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

(67)m=	15.11	13.42	10.92	8.26	6.18	5.22	5.64	7.33	9.83	12.48	14.57	15.53	(67)

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

(68)m=	169.53	171.29	166.86	157.42	145.51	134.31	126.83	125.07	129.5	138.94	150.85	162.05	(68)

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

(69)m=	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	(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=	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	-77.73	(71)

Water heating gains (Table 5)

(72)m=	118.02	116.16	112.31	107.07	103.66	98.87	94.8	100.02	101.87	107.3	113.42	116.17	(72)

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

(73)m=	354.81	353.02	342.23	324.9	307.49	290.55	279.41	284.56	293.35	310.87	330.99	345.9	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest	0.9x	0.77	x	3.24	x	36.79		0.45	x	0.7	=	26.02	(79)
Southwest	0.9x	0.77	x	2.52	x	36.79		0.45	x	0.7	=	20.24	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.45	x	0.7	=	44.33	(79)
Southwest	0.9x	0.77	x	2.52	x	62.67		0.45	x	0.7	=	34.48	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.45	x	0.7	=	60.65	(79)
Southwest	0.9x	0.77	x	2.52	x	85.75		0.45	x	0.7	=	47.17	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.45	x	0.7	=	75.15	(79)
Southwest	0.9x	0.77	x	2.52	x	106.25		0.45	x	0.7	=	58.45	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.45	x	0.7	=	84.17	(79)
Southwest	0.9x	0.77	x	2.52	x	119.01		0.45	x	0.7	=	65.47	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.45	x	0.7	=	83.56	(79)
Southwest	0.9x	0.77	x	2.52	x	118.15		0.45	x	0.7	=	64.99	(79)
Southwest	0.9x	0.77	x	3.24	x	113.91		0.45	x	0.7	=	80.57	(79)
Southwest	0.9x	0.77	x	2.52	x	113.91		0.45	x	0.7	=	62.66	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.45	x	0.7	=	73.83	(79)
Southwest	0.9x	0.77	x	2.52	x	104.39		0.45	x	0.7	=	57.43	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.45	x	0.7	=	65.67	(79)
Southwest	0.9x	0.77	x	2.52	x	92.85		0.45	x	0.7	=	51.08	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.45	x	0.7	=	48.99	(79)
Southwest	0.9x	0.77	x	2.52	x	69.27		0.45	x	0.7	=	38.1	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.45	x	0.7	=	31.17	(79)
Southwest	0.9x	0.77	x	2.52	x	44.07		0.45	x	0.7	=	24.24	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.45	x	0.7	=	22.27	(79)
Southwest	0.9x	0.77	x	2.52	x	31.49		0.45	x	0.7	=	17.32	(79)
Northwest	0.9x	0.77	x	7.56	x	11.28	x	0.45	x	0.7	=	18.62	(81)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	7.56	x	22.97	x	0.45	x	0.7	=	37.9	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	7.56	x	41.38	x	0.45	x	0.7	=	68.29	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	7.56	x	67.96	x	0.45	x	0.7	=	112.15	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	7.56	x	91.35	x	0.45	x	0.7	=	150.75	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)

Northwest	0.9x	0.77	x	7.56	x	97.38	x	0.45	x	0.7	=	160.71	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	7.56	x	91.1	x	0.45	x	0.7	=	150.35	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	7.56	x	72.63	x	0.45	x	0.7	=	119.86	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	7.56	x	50.42	x	0.45	x	0.7	=	83.21	(81)
Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	7.56	x	28.07	x	0.45	x	0.7	=	46.32	(81)
Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest	0.9x	0.77	x	7.56	x	14.2	x	0.45	x	0.7	=	23.43	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	7.56	x	9.21	x	0.45	x	0.7	=	15.21	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)

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

(83)m=	76.85	141.07	220.01	317.84	397.3	412.59	390.22	328.17	253.45	163.19	93.9	64.57	(83)

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

(84)m=	431.66	494.09	562.24	642.74	704.8	703.14	669.64	612.73	546.81	474.06	424.9	410.47	(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=	0.95	0.93	0.89	0.81	0.69	0.54	0.42	0.47	0.67	0.85	0.93	0.95	(86)

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

(87)m=	18.66	18.94	19.41	20.01	20.5	20.81	20.93	20.91	20.66	20.02	19.25	18.61	(87)

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

(88)m=	19.9	19.91	19.91	19.92	19.92	19.93	19.93	19.94	19.93	19.92	19.92	19.91	(88)

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

(89)m=	0.94	0.92	0.87	0.78	0.64	0.47	0.33	0.38	0.61	0.82	0.92	0.95	(89)

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

(90)m=	16.81	17.21	17.88	18.72	19.38	19.77	19.89	19.87	19.6	18.76	17.66	16.74	(90)

fLA = Living area ÷ (4) = 0.42 (91)

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

(92)m=	17.59	17.94	18.52	19.26	19.85	20.21	20.33	20.31	20.04	19.29	18.33	17.53	(92)

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

(93)m=	17.59	17.94	18.52	19.26	19.85	20.21	20.33	20.31	20.04	19.29	18.33	17.53	(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=	0.92	0.89	0.85	0.76	0.64	0.49	0.36	0.41	0.61	0.8	0.89	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	397.26	441.5	475.91	489.44	451.05	345.64	244.18	250.8	335.64	380.04	379.37	380.8	(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=	951.1	931.03	856.45	729.31	572.23	388.91	258.45	270.29	414.33	610.11	792.11	944.95	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	412.05	328.96	283.12	172.71	90.16	0	0	0	0	171.17	297.17	419.72	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2175.07	(98)
Space heating requirement in kWh/m²/year		37.09	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2175.07	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2610.08	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1915.08	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2298.1	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	49.08	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

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Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		111.8	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	111.8	(331)
Energy for lighting (calculated in Appendix L)		266.91	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4556.82	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1224.68	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.47	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1250.16	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1250.16	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	58.03	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	138.53	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1			0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				1067.8	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				18.21	(384)
EI rating (section 14)					86.2	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block S - Ground Floor

Address :	S, Block S, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	67.39	(1a) x	2.5	(2a) =	168.47	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	67.39	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		168.47	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			3.48	x1/[1/(1.2)+ 0.04]		=	3.98			(27)
Windows Type 2			4.41	x1/[1/(1.2)+ 0.04]		=	5.05			(27)
Windows Type 3			3.15	x1/[1/(1.2)+ 0.04]		=	3.61			(27)
Floor			67.39	x	0.1	=	6.739			(28)
Walls Type1	41.92	11.04	30.88	x	0.16	=	4.94			(29)
Walls Type2	7.05	1.91	5.14	x	0.15	=	0.77			(29)
Total area of elements, m²			116.36							(31)
Party wall			34.88	x	0	=	0			(32)
Party ceiling			67.39							(32b)

** 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) =	27	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	11328.2	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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		8.92	(36)

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

Total fabric heat loss	(33) + (36) =	35.92	(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

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(38)m=	16.46	16.26	16.07	15.09	14.9	13.93	13.93	13.73	14.32	14.9	15.29	15.68	(38)

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

(39)m=	52.38	52.18	51.99	51.01	50.82	49.85	49.85	49.65	50.24	50.82	51.21	51.6	

Average = Sum(39)$_{1...12}$ /12= 50.97 (39)

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

(40)m=	0.78	0.77	0.77	0.76	0.75	0.74	0.74	0.74	0.75	0.75	0.76	0.77	

Average = Sum(40)$_{1...12}$ /12= 0.76 (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 2.18 (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 86 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	94.6	91.16	87.72	84.28	80.84	77.4	77.4	80.84	84.28	87.72	91.16	94.6	

Total = Sum(44)$_{1...12}$ = 1032.02 (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=	140.29	122.7	126.62	110.39	105.92	91.4	84.7	97.19	98.35	114.62	125.11	135.87	

Total = Sum(45)$_{1...12}$ = 1353.14 (45)

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

(46)m=	21.04	18.41	18.99	16.56	15.89	13.71	12.7	14.58	14.75	17.19	18.77	20.38	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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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=	195.57	172.63	181.89	163.88	161.2	144.89	139.97	152.47	151.84	169.89	178.61	191.14	(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=	195.57	172.63	181.89	163.88	161.2	144.89	139.97	152.47	151.84	169.89	178.61	191.14

Output from water heater (annual)$_{1…12}$ — 2003.98 (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=	90.87	80.74	86.32	79.5	79.44	73.19	72.38	76.54	75.5	82.33	84.4	89.4	(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=	109.06	109.06	109.06	109.06	109.06	109.06	109.06	109.06	109.06	109.06	109.06	109.06	(66)

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

(67)m=	17.7	15.72	12.78	9.68	7.23	6.11	6.6	8.58	11.51	14.62	17.06	18.19	(67)

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

(68)m=	191.13	193.11	188.12	177.48	164.04	151.42	142.99	141	146	156.64	170.07	182.7	(68)

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

(69)m=	33.91	33.91	33.91	33.91	33.91	33.91	33.91	33.91	33.91	33.91	33.91	33.91	(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=	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	(71)

Water heating gains (Table 5)

(72)m=	122.14	120.15	116.02	110.41	106.77	101.65	97.29	102.87	104.86	110.66	117.22	120.16	(72)

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

(73)m=	386.68	384.7	372.64	353.28	333.77	314.89	302.59	308.17	318.09	337.64	360.07	376.76	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a	g_ Table 6b		FF Table 6c		Gains (W)	
Southwest 0.9x	0.77	x	3.48	x	36.79	0.45	x	0.7	=	27.95	(79)
Southwest 0.9x	0.77	x	3.48	x	62.67	0.45	x	0.7	=	47.61	(79)

Southwest	0.9x	0.77	x	3.48	x	85.75		0.45	x	0.7	=	65.14	(79)
Southwest	0.9x	0.77	x	3.48	x	106.25		0.45	x	0.7	=	80.72	(79)
Southwest	0.9x	0.77	x	3.48	x	119.01		0.45	x	0.7	=	90.41	(79)
Southwest	0.9x	0.77	x	3.48	x	118.15		0.45	x	0.7	=	89.75	(79)
Southwest	0.9x	0.77	x	3.48	x	113.91		0.45	x	0.7	=	86.53	(79)
Southwest	0.9x	0.77	x	3.48	x	104.39		0.45	x	0.7	=	79.3	(79)
Southwest	0.9x	0.77	x	3.48	x	92.85		0.45	x	0.7	=	70.54	(79)
Southwest	0.9x	0.77	x	3.48	x	69.27		0.45	x	0.7	=	52.62	(79)
Southwest	0.9x	0.77	x	3.48	x	44.07		0.45	x	0.7	=	33.48	(79)
Southwest	0.9x	0.77	x	3.48	x	31.49		0.45	x	0.7	=	23.92	(79)
Northwest	0.9x	0.77	x	4.41	x	11.28	x	0.45	x	0.7	=	10.86	(81)
Northwest	0.9x	0.77	x	3.15	x	11.28	x	0.45	x	0.7	=	7.76	(81)
Northwest	0.9x	0.77	x	4.41	x	22.97	x	0.45	x	0.7	=	22.11	(81)
Northwest	0.9x	0.77	x	3.15	x	22.97	x	0.45	x	0.7	=	15.79	(81)
Northwest	0.9x	0.77	x	4.41	x	41.38	x	0.45	x	0.7	=	39.83	(81)
Northwest	0.9x	0.77	x	3.15	x	41.38	x	0.45	x	0.7	=	28.45	(81)
Northwest	0.9x	0.77	x	4.41	x	67.96	x	0.45	x	0.7	=	65.42	(81)
Northwest	0.9x	0.77	x	3.15	x	67.96	x	0.45	x	0.7	=	46.73	(81)
Northwest	0.9x	0.77	x	4.41	x	91.35	x	0.45	x	0.7	=	87.94	(81)
Northwest	0.9x	0.77	x	3.15	x	91.35	x	0.45	x	0.7	=	62.81	(81)
Northwest	0.9x	0.77	x	4.41	x	97.38	x	0.45	x	0.7	=	93.75	(81)
Northwest	0.9x	0.77	x	3.15	x	97.38	x	0.45	x	0.7	=	66.96	(81)
Northwest	0.9x	0.77	x	4.41	x	91.1	x	0.45	x	0.7	=	87.7	(81)
Northwest	0.9x	0.77	x	3.15	x	91.1	x	0.45	x	0.7	=	62.64	(81)
Northwest	0.9x	0.77	x	4.41	x	72.63	x	0.45	x	0.7	=	69.92	(81)
Northwest	0.9x	0.77	x	3.15	x	72.63	x	0.45	x	0.7	=	49.94	(81)
Northwest	0.9x	0.77	x	4.41	x	50.42	x	0.45	x	0.7	=	48.54	(81)
Northwest	0.9x	0.77	x	3.15	x	50.42	x	0.45	x	0.7	=	34.67	(81)
Northwest	0.9x	0.77	x	4.41	x	28.07	x	0.45	x	0.7	=	27.02	(81)
Northwest	0.9x	0.77	x	3.15	x	28.07	x	0.45	x	0.7	=	19.3	(81)
Northwest	0.9x	0.77	x	4.41	x	14.2	x	0.45	x	0.7	=	13.67	(81)
Northwest	0.9x	0.77	x	3.15	x	14.2	x	0.45	x	0.7	=	9.76	(81)
Northwest	0.9x	0.77	x	4.41	x	9.21	x	0.45	x	0.7	=	8.87	(81)
Northwest	0.9x	0.77	x	3.15	x	9.21	x	0.45	x	0.7	=	6.34	(81)

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

(83)m=	46.57	85.51	133.43	192.86	241.16	250.47	236.88	199.16	153.75	98.94	56.91	39.13	(83)

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

(84)m=	433.25	470.21	506.07	546.15	574.93	565.36	539.47	507.33	471.83	436.58	416.98	415.88	(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

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(86)m=	0.95	0.93	0.9	0.82	0.69	0.53	0.4	0.43	0.65	0.84	0.93	0.96	(86)

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

(87)m=	19.59	19.78	20.09	20.48	20.77	20.94	20.98	20.98	20.87	20.51	20	19.56	(87)

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

(88)m=	20.27	20.28	20.28	20.29	20.29	20.31	20.31	20.31	20.3	20.29	20.29	20.28	(88)

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

(89)m=	0.94	0.93	0.89	0.8	0.66	0.48	0.34	0.37	0.6	0.82	0.92	0.95	(89)

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

(90)m=	18.37	18.64	19.08	19.64	20.03	20.25	20.29	20.29	20.17	19.69	18.97	18.34	(90)

fLA = Living area ÷ (4) = 0.42 (91)

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

(92)m=	18.88	19.11	19.5	19.99	20.34	20.53	20.58	20.58	20.46	20.03	19.4	18.85	(92)

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

(93)m=	18.88	19.11	19.5	19.99	20.34	20.53	20.58	20.58	20.46	20.03	19.4	18.85	(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=	0.93	0.91	0.87	0.79	0.66	0.5	0.36	0.4	0.61	0.81	0.9	0.94	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	403.18	427.79	440.04	430.68	380.74	280.41	194.63	201.99	287.45	353.74	376.34	389.76	(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=	763.62	741.66	675.81	565.78	439.28	295.83	198.45	207.37	319.58	479.23	630.07	755.92	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	268.16	210.92	175.41	97.27	43.56	0	0	0	0	93.37	182.69	272.42	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1343.81 (98)

Space heating requirement in kWh/m²/year 19.94 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)

Space heating	**kWh/year**
Annual space heating requirement	1343.81

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1612.57	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2003.98	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2404.78	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.17	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		128.46	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	128.46	(331)
Energy for lighting (calculated in Appendix L)		312.51	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3728.24	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1002.41	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.85	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1023.26	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1023.26	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	66.67	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	162.19	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				873.21	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				12.96	(384)
EI rating (section 14)					89.59	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block S - Mid Floor

Address : S, Block S, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	67.39	(1a)	x	2.5	(2a)	=	168.47	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	67.39	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			168.47	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			3.48	x1/[1/(1.2)+ 0.04]		=	3.98			(27)
Windows Type 2			4.41	x1/[1/(1.2)+ 0.04]		=	5.05			(27)
Windows Type 3			3.15	x1/[1/(1.2)+ 0.04]		=	3.61			(27)
Walls Type1	41.92	11.04	30.88	x	0.16	=	4.94			(29)
Walls Type2	7.05	1.91	5.14	x	0.15	=	0.77			(29)
Total area of elements, m²			48.97							(31)
Party wall			34.88	x	0	=	0			(32)
Party floor			67.39							(32a)
Party ceiling			67.39							(32b)

** 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) = 20.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6610.9 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 4.88 (36)

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

Total fabric heat loss (33) + (36) = 25.15 (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

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(38)m=	16.46	16.26	16.07	15.09	14.9	13.93	13.93	13.73	14.32	14.9	15.29	15.68	(38)

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

(39)m=	41.6	41.41	41.21	40.24	40.05	39.07	39.07	38.88	39.46	40.05	40.43	40.82	

Average = Sum(39)$_{1\ldots12}$ /12= 40.19 (39)

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

(40)m=	0.62	0.61	0.61	0.6	0.59	0.58	0.58	0.58	0.59	0.59	0.6	0.61	

Average = Sum(40)$_{1\ldots12}$ /12= 0.6 (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 2.18 (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 86 (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=	94.6	91.16	87.72	84.28	80.84	77.4	77.4	80.84	84.28	87.72	91.16	94.6	

Total = Sum(44)$_{1\ldots12}$ = 1032.02 (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=	140.29	122.7	126.62	110.39	105.92	91.4	84.7	97.19	98.35	114.62	125.11	135.87	

Total = Sum(45)$_{1\ldots12}$ = 1353.14 (45)

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

(46)m=	21.04	18.41	18.99	16.56	15.89	13.71	12.7	14.58	14.75	17.19	18.77	20.38	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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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=	195.57	172.63	181.89	163.88	161.2	144.89	139.97	152.47	151.84	169.89	178.61	191.14	(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=	195.57	172.63	181.89	163.88	161.2	144.89	139.97	152.47	151.84	169.89	178.61	191.14

Output from water heater (annual)$_{1...12}$ | 2003.98 | (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=	90.87	80.74	86.32	79.5	79.44	73.19	72.38	76.54	75.5	82.33	84.4	89.4	(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=	109.06	109.06	109.06	109.06	109.06	109.06	109.06	109.06	109.06	109.06	109.06	109.06	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	17.7	15.72	12.78	9.68	7.23	6.11	6.6	8.58	11.51	14.62	17.06	18.19	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	191.13	193.11	188.12	177.48	164.04	151.42	142.99	141	146	156.64	170.07	182.7	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	33.91	33.91	33.91	33.91	33.91	33.91	33.91	33.91	33.91	33.91	33.91	33.91	(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=	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	-87.25	(71)
Water heating gains (Table 5)													
(72)m=	122.14	120.15	116.02	110.41	106.77	101.65	97.29	102.87	104.86	110.66	117.22	120.16	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	386.68	384.7	372.64	353.28	333.77	314.89	302.59	308.17	318.09	337.64	360.07	376.76	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a	g_ Table 6b		FF Table 6c		Gains (W)	
Southwest 0.9x	0.77	x	3.48	x	36.79	0.45	x	0.7	=	27.95	(79)
Southwest 0.9x	0.77	x	3.48	x	62.67	0.45	x	0.7	=	47.61	(79)

Southwest	0.9x	0.77	x	3.48	x	85.75		0.45	x	0.7	=	65.14	(79)
Southwest	0.9x	0.77	x	3.48	x	106.25		0.45	x	0.7	=	80.72	(79)
Southwest	0.9x	0.77	x	3.48	x	119.01		0.45	x	0.7	=	90.41	(79)
Southwest	0.9x	0.77	x	3.48	x	118.15		0.45	x	0.7	=	89.75	(79)
Southwest	0.9x	0.77	x	3.48	x	113.91		0.45	x	0.7	=	86.53	(79)
Southwest	0.9x	0.77	x	3.48	x	104.39		0.45	x	0.7	=	79.3	(79)
Southwest	0.9x	0.77	x	3.48	x	92.85		0.45	x	0.7	=	70.54	(79)
Southwest	0.9x	0.77	x	3.48	x	69.27		0.45	x	0.7	=	52.62	(79)
Southwest	0.9x	0.77	x	3.48	x	44.07		0.45	x	0.7	=	33.48	(79)
Southwest	0.9x	0.77	x	3.48	x	31.49		0.45	x	0.7	=	23.92	(79)
Northwest	0.9x	0.77	x	4.41	x	11.28	x	0.45	x	0.7	=	10.86	(81)
Northwest	0.9x	0.77	x	3.15	x	11.28	x	0.45	x	0.7	=	7.76	(81)
Northwest	0.9x	0.77	x	4.41	x	22.97	x	0.45	x	0.7	=	22.11	(81)
Northwest	0.9x	0.77	x	3.15	x	22.97	x	0.45	x	0.7	=	15.79	(81)
Northwest	0.9x	0.77	x	4.41	x	41.38	x	0.45	x	0.7	=	39.83	(81)
Northwest	0.9x	0.77	x	3.15	x	41.38	x	0.45	x	0.7	=	28.45	(81)
Northwest	0.9x	0.77	x	4.41	x	67.96	x	0.45	x	0.7	=	65.42	(81)
Northwest	0.9x	0.77	x	3.15	x	67.96	x	0.45	x	0.7	=	46.73	(81)
Northwest	0.9x	0.77	x	4.41	x	91.35	x	0.45	x	0.7	=	87.94	(81)
Northwest	0.9x	0.77	x	3.15	x	91.35	x	0.45	x	0.7	=	62.81	(81)
Northwest	0.9x	0.77	x	4.41	x	97.38	x	0.45	x	0.7	=	93.75	(81)
Northwest	0.9x	0.77	x	3.15	x	97.38	x	0.45	x	0.7	=	66.96	(81)
Northwest	0.9x	0.77	x	4.41	x	91.1	x	0.45	x	0.7	=	87.7	(81)
Northwest	0.9x	0.77	x	3.15	x	91.1	x	0.45	x	0.7	=	62.64	(81)
Northwest	0.9x	0.77	x	4.41	x	72.63	x	0.45	x	0.7	=	69.92	(81)
Northwest	0.9x	0.77	x	3.15	x	72.63	x	0.45	x	0.7	=	49.94	(81)
Northwest	0.9x	0.77	x	4.41	x	50.42	x	0.45	x	0.7	=	48.54	(81)
Northwest	0.9x	0.77	x	3.15	x	50.42	x	0.45	x	0.7	=	34.67	(81)
Northwest	0.9x	0.77	x	4.41	x	28.07	x	0.45	x	0.7	=	27.02	(81)
Northwest	0.9x	0.77	x	3.15	x	28.07	x	0.45	x	0.7	=	19.3	(81)
Northwest	0.9x	0.77	x	4.41	x	14.2	x	0.45	x	0.7	=	13.67	(81)
Northwest	0.9x	0.77	x	3.15	x	14.2	x	0.45	x	0.7	=	9.76	(81)
Northwest	0.9x	0.77	x	4.41	x	9.21	x	0.45	x	0.7	=	8.87	(81)
Northwest	0.9x	0.77	x	3.15	x	9.21	x	0.45	x	0.7	=	6.34	(81)

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

(83)m=	46.57	85.51	133.43	192.86	241.16	250.47	236.88	199.16	153.75	98.94	56.91	39.13	(83)

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

(84)m=	433.25	470.21	506.07	546.15	574.93	565.36	539.47	507.33	471.83	436.58	416.98	415.88	(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

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(86)m=	0.94	0.91	0.86	0.76	0.6	0.43	0.32	0.35	0.55	0.79	0.9	0.94	(86)

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

(87)m=	20.06	20.23	20.47	20.76	20.92	20.98	21	21	20.96	20.76	20.39	20.04	(87)

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

(88)m=	20.41	20.42	20.42	20.43	20.44	20.45	20.45	20.45	20.44	20.44	20.43	20.42	(88)

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

(89)m=	0.93	0.9	0.85	0.73	0.57	0.4	0.28	0.31	0.51	0.76	0.89	0.94	(89)

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

(90)m=	19.14	19.38	19.73	20.13	20.34	20.43	20.45	20.45	20.4	20.14	19.63	19.12	(90)

fLA = Living area ÷ (4) = 0.42 (91)

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

(92)m=	19.53	19.73	20.04	20.39	20.58	20.66	20.68	20.68	20.63	20.4	19.95	19.51	(92)

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

(93)m=	19.53	19.73	20.04	20.39	20.58	20.66	20.68	20.68	20.63	20.4	19.95	19.51	(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=	0.92	0.89	0.84	0.73	0.58	0.41	0.29	0.33	0.53	0.76	0.88	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	398.01	419.09	424.2	399.78	335.18	233.3	158.59	165.22	247.96	331.53	367.18	385.32	(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=	633.43	614.19	558.04	462.38	355.75	236.93	159.26	166.25	257.85	392.35	519.45	624.85	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	175.16	131.11	99.58	45.07	15.3	0	0	0	0	45.25	109.63	178.21	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 799.31 (98)

Space heating requirement in kWh/m²/year 11.86 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)

Space heating	**kWh/year**
Annual space heating requirement	799.31

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	959.17	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2003.98	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2404.78	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	33.64	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		128.46	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	128.46	(331)
Energy for lighting (calculated in Appendix L)		312.51	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3074.85	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	839.37	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	17.46	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	856.83	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				856.83	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	66.67	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	162.19	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =		-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				706.79	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				10.49	(384)
EI rating (section 14)					91.57	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block S - Top Floor

Address : S, Block S, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.12	(1a) x	2.5	(2a) =	125.3	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.12	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	125.3	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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 *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*		0	(11)
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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 2			5.88	x1/[1/(1.2)+ 0.04]		=	6.73			(27)
Windows Type 3			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Walls Type1	37.65	10.74	26.91	x	0.16	=	4.31			(29)
Walls Type2	4.7	1.91	2.79	x	0.15	=	0.42			(29)
Roof	50.12	0	50.12	x	0.1	=	5.01			(30)
Total area of elements, m²			92.47							(31)
Party wall			33.88	x	0	=	0			(32)
Party floor			50.12							(32a)

** 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) =	23.94	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	4247.55	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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		13.07	(36)
if details of thermal bridging are not known (36) = 0.05 x (31)			
Total fabric heat loss	(33) + (36) =	37.01	(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

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(38)m=	12.24	12.09	11.95	11.23	11.08	10.36	10.36	10.21	10.65	11.08	11.37	11.66	(38)

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

(39)m=	49.25	49.11	48.96	48.24	48.1	47.37	47.37	47.23	47.66	48.1	48.38	48.67	

Average = $Sum(39)_{1...12}$ /12= 48.2 (39)

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

(40)m=	0.98	0.98	0.98	0.96	0.96	0.95	0.95	0.94	0.95	0.96	0.97	0.97	

Average = $Sum(40)_{1...12}$ /12= 0.96 (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 1.69 (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 74.42 (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=	81.87	78.89	75.91	72.94	69.96	66.98	66.98	69.96	72.94	75.91	78.89	81.87	

Total = $Sum(44)_{1...12}$ = 893.09 (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=	121.41	106.18	109.57	95.53	91.66	79.1	73.29	84.1	85.11	99.19	108.27	117.57	

Total = $Sum(45)_{1...12}$ = 1170.98 (45)

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

(46)m=	18.21	15.93	16.44	14.33	13.75	11.86	10.99	12.62	12.77	14.88	16.24	17.64	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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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=	176.68	156.11	164.85	149.02	146.94	132.59	128.57	139.38	138.6	154.46	161.76	172.85	(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=	176.68	156.11	164.85	149.02	146.94	132.59	128.57	139.38	138.6	154.46	161.76	172.85

Output from water heater (annual) $_{1...12}$	1821.82	(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=	84.59	75.25	80.65	74.56	74.7	69.09	68.59	72.19	71.09	77.2	78.79	83.31	(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=	84.68	84.68	84.68	84.68	84.68	84.68	84.68	84.68	84.68	84.68	84.68	84.68	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.17	11.7	9.52	7.2	5.38	4.55	4.91	6.39	8.57	10.88	12.7	13.54	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	147.55	149.08	145.22	137	126.64	116.89	110.38	108.85	112.71	120.92	131.29	141.04	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	31.47	(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=	-67.75	-67.75	-67.75	-67.75	-67.75	-67.75	-67.75	-67.75	-67.75	-67.75	-67.75	-67.75	(71)
Water heating gains (Table 5)													
(72)m=	113.69	111.98	108.41	103.55	100.4	95.96	92.19	97.02	98.74	103.76	109.44	111.98	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	322.82	321.16	311.54	296.16	280.83	265.81	255.89	260.66	268.42	283.97	301.83	314.96	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(75)
Northeast 0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(75)

Northeast	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(75)
Northeast	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(75)
Northeast	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(75)
Northeast	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(75)
Northeast	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(75)
Northeast	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(75)
Northeast	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(75)
Northeast	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(75)
Northeast	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(75)
Northeast	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(75)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	5.88	x	11.28	x	0.45	x	0.7	=	14.48	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	5.88	x	22.97	x	0.45	x	0.7	=	29.48	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	5.88	x	41.38	x	0.45	x	0.7	=	53.11	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	5.88	x	67.96	x	0.45	x	0.7	=	87.23	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest	0.9x	0.77	x	5.88	x	91.35	x	0.45	x	0.7	=	117.25	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	5.88	x	97.38	x	0.45	x	0.7	=	125	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	5.88	x	91.1	x	0.45	x	0.7	=	116.94	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	5.88	x	72.63	x	0.45	x	0.7	=	93.22	(81)
Northwest	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest	0.9x	0.77	x	5.88	x	50.42	x	0.45	x	0.7	=	64.72	(81)
Northwest	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest	0.9x	0.77	x	5.88	x	28.07	x	0.45	x	0.7	=	36.03	(81)
Northwest	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest	0.9x	0.77	x	5.88	x	14.2	x	0.45	x	0.7	=	18.22	(81)
Northwest	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)
Northwest	0.9x	0.77	x	5.88	x	9.21	x	0.45	x	0.7	=	11.83	(81)

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

(83)m=	26.45	53.85	97.01	159.32	214.16	228.32	213.59	170.27	118.21	65.8	33.28	21.6	(83)

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

(84)m=	349.27	375	408.56	455.49	494.99	494.12	469.48	430.94	386.64	349.78	335.12	336.56	(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=	0.95	0.94	0.9	0.83	0.71	0.55	0.42	0.47	0.68	0.86	0.93	0.95	(86)

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

(87)m=	19.14	19.33	19.71	20.21	20.63	20.88	20.96	20.94	20.75	20.24	19.63	19.11	(87)

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

(88)m=	20.1	20.1	20.1	20.11	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11	(88)

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

(89)m=	0.94	0.93	0.89	0.81	0.67	0.49	0.35	0.39	0.63	0.84	0.92	0.95	(89)

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

(90)m=	17.61	17.89	18.42	19.14	19.7	20.01	20.1	20.09	19.87	19.19	18.32	17.57	(90)

fLA = Living area ÷ (4) = 0.42 (91)

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

(92)m=	18.25	18.49	18.96	19.59	20.09	20.37	20.46	20.45	20.24	19.63	18.86	18.22	(92)

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

(93)m=	18.25	18.49	18.96	19.59	20.09	20.37	20.46	20.45	20.24	19.63	18.86	18.22	(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=	0.92	0.91	0.87	0.79	0.67	0.51	0.37	0.42	0.64	0.82	0.9	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	322.98	340.27	355.07	359.56	329.19	250.06	175.77	181.12	245.74	286.74	301.53	313.22	(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=	687.09	667.46	610.02	515.68	403.36	273.53	182.78	191.04	292.71	434.29	569.2	682.23	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	270.9	219.87	189.69	112.41	55.18	0	0	0	0	109.77	192.72	274.54	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1425.08 (98)

Space heating requirement in kWh/m²/year 28.43 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)

Space heating	**kWh/year**
Annual space heating requirement	1425.08

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1710.1	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1821.82	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2186.18	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	38.96	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		95.54	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	95.54	(331)
Energy for lighting (calculated in Appendix L)		232.64	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3494.39	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	972.2	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.22	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	992.42	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				992.42	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	49.59	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	120.74	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				783.84	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.64	(384)
EI rating (section 14)					88.96	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.49

Property Address: Block T - Ground Floor

Address : T, Block T, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	87.51	(1a) x	2.5	(2a) =	218.78	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	218.78	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			4	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Windows Type 2			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Windows Type 3			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 4			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 5			4.2	x1/[1/(1.2)+ 0.04]		=	4.81			(27)
Windows Type 6			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 7			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 8			4.2	x1/[1/(1.2)+ 0.04]		=	4.81			(27)
Windows Type 9			4.2	x1/[1/(1.2)+ 0.04]		=	4.81			(27)
Floor			87.51	x	0.1	=	8.751			(28)
Walls Type1	65.55	25.2	40.35	x	0.16	=	6.46			(29)
Walls Type2	53.95	1.91	52.04	x	0.15	=	7.83			(29)
Total area of elements, m²			207.01							(31)
Party ceiling			87.51							(32b)

** 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) = 53.8 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13082.91 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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		15.17	(36)
if details of thermal bridging are not known (36) = 0.05 x (31)			
Total fabric heat loss	(33) + (36) =	68.97	(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=	21.37	21.12	20.86	19.6	19.35	18.09	18.09	17.83	18.59	19.35	19.85	20.36	(38)

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

(39)m=	90.34	90.09	89.84	88.57	88.32	87.06	87.06	86.8	87.56	88.32	88.82	89.33	

Average = $Sum(39)_{1...12}$ /12= 88.51 (39)

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

(40)m=	1.03	1.03	1.03	1.01	1.01	0.99	0.99	0.99	1	1.01	1.02	1.02	

Average = $Sum(40)_{1...12}$ /12= 1.01 (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 2.59 (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 95.71 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	105.29	101.46	97.63	93.8	89.97	86.14	86.14	89.97	93.8	97.63	101.46	105.29

Total = $Sum(44)_{1...12}$ = 1148.57 (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=	156.14	136.56	140.92	122.85	117.88	101.72	94.26	108.17	109.46	127.56	139.24	151.21

Total = $Sum(45)_{1...12}$ = 1505.96 (45)

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

(46)m=	23.42	20.48	21.14	18.43	17.68	15.26	14.14	16.22	16.42	19.13	20.89	22.68	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		0	(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) =	110	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02	(51)
If community heating see section 4.3			
Volume factor from Table 2a		1.03	(52)
Temperature factor from Table 2b		0.6	(53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	211.41	186.48	196.19	176.35	173.16	155.22	149.54	163.44	162.95	182.84	192.74	206.49	(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=	211.41	186.48	196.19	176.35	173.16	155.22	149.54	163.44	162.95	182.84	192.74	206.49

Output from water heater (annual)$_{1...12}$ 2156.8 (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=	96.14	85.35	91.08	83.64	83.42	76.62	75.56	80.19	79.19	86.64	89.09	94.5	(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=	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	(66)

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

(67)m=	20.9	18.56	15.1	11.43	8.54	7.21	7.79	10.13	13.6	17.26	20.15	21.48	(67)

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

(68)m=	234.42	236.85	230.72	217.67	201.2	185.72	175.37	172.94	179.07	192.12	208.6	224.08	(68)

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

(69)m=	35.95	35.95	35.95	35.95	35.95	35.95	35.95	35.95	35.95	35.95	35.95	35.95	(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=	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	(71)

Water heating gains (Table 5)

(72)m=	129.22	127	122.41	116.17	112.12	106.41	101.56	107.78	109.99	116.45	123.74	127.01	(72)

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

(73)m=	446.39	444.27	430.08	407.13	383.71	361.19	346.58	352.7	364.51	387.68	414.34	434.42	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	1.44	x	11.28	x	0.45	x	0.7	=	3.55	(75)
Northeast	0.9x	0.77	x	1.44	x	11.28	x	0.45	x	0.7	=	3.55	(75)
Northeast	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(75)
Northeast	0.9x	0.77	x	4.2	x	11.28	x	0.45	x	0.7	=	10.34	(75)
Northeast	0.9x	0.77	x	1.44	x	22.97	x	0.45	x	0.7	=	7.22	(75)
Northeast	0.9x	0.77	x	1.44	x	22.97	x	0.45	x	0.7	=	7.22	(75)
Northeast	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(75)
Northeast	0.9x	0.77	x	4.2	x	22.97	x	0.45	x	0.7	=	21.06	(75)
Northeast	0.9x	0.77	x	1.44	x	41.38	x	0.45	x	0.7	=	13.01	(75)
Northeast	0.9x	0.77	x	1.44	x	41.38	x	0.45	x	0.7	=	13.01	(75)
Northeast	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(75)
Northeast	0.9x	0.77	x	4.2	x	41.38	x	0.45	x	0.7	=	37.94	(75)
Northeast	0.9x	0.77	x	1.44	x	67.96	x	0.45	x	0.7	=	21.36	(75)
Northeast	0.9x	0.77	x	1.44	x	67.96	x	0.45	x	0.7	=	21.36	(75)
Northeast	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(75)
Northeast	0.9x	0.77	x	4.2	x	67.96	x	0.45	x	0.7	=	62.3	(75)
Northeast	0.9x	0.77	x	1.44	x	91.35	x	0.45	x	0.7	=	28.71	(75)
Northeast	0.9x	0.77	x	1.44	x	91.35	x	0.45	x	0.7	=	28.71	(75)
Northeast	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(75)
Northeast	0.9x	0.77	x	4.2	x	91.35	x	0.45	x	0.7	=	83.75	(75)
Northeast	0.9x	0.77	x	1.44	x	97.38	x	0.45	x	0.7	=	30.61	(75)
Northeast	0.9x	0.77	x	1.44	x	97.38	x	0.45	x	0.7	=	30.61	(75)
Northeast	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(75)
Northeast	0.9x	0.77	x	4.2	x	97.38	x	0.45	x	0.7	=	89.29	(75)
Northeast	0.9x	0.77	x	1.44	x	91.1	x	0.45	x	0.7	=	28.64	(75)
Northeast	0.9x	0.77	x	1.44	x	91.1	x	0.45	x	0.7	=	28.64	(75)
Northeast	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(75)
Northeast	0.9x	0.77	x	4.2	x	91.1	x	0.45	x	0.7	=	83.53	(75)
Northeast	0.9x	0.77	x	1.44	x	72.63	x	0.45	x	0.7	=	22.83	(75)
Northeast	0.9x	0.77	x	1.44	x	72.63	x	0.45	x	0.7	=	22.83	(75)
Northeast	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(75)
Northeast	0.9x	0.77	x	4.2	x	72.63	x	0.45	x	0.7	=	66.59	(75)
Northeast	0.9x	0.77	x	1.44	x	50.42	x	0.45	x	0.7	=	15.85	(75)
Northeast	0.9x	0.77	x	1.44	x	50.42	x	0.45	x	0.7	=	15.85	(75)
Northeast	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(75)
Northeast	0.9x	0.77	x	4.2	x	50.42	x	0.45	x	0.7	=	46.23	(75)
Northeast	0.9x	0.77	x	1.44	x	28.07	x	0.45	x	0.7	=	8.82	(75)
Northeast	0.9x	0.77	x	1.44	x	28.07	x	0.45	x	0.7	=	8.82	(75)
Northeast	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(75)

Northeast	0.9x	0.77	x	4.2	x	28.07	x	0.45	x	0.7	=	25.73	(75)
Northeast	0.9x	0.77	x	1.44	x	14.2	x	0.45	x	0.7	=	4.46	(75)
Northeast	0.9x	0.77	x	1.44	x	14.2	x	0.45	x	0.7	=	4.46	(75)
Northeast	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(75)
Northeast	0.9x	0.77	x	4.2	x	14.2	x	0.45	x	0.7	=	13.02	(75)
Northeast	0.9x	0.77	x	1.44	x	9.21	x	0.45	x	0.7	=	2.9	(75)
Northeast	0.9x	0.77	x	1.44	x	9.21	x	0.45	x	0.7	=	2.9	(75)
Northeast	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(75)
Northeast	0.9x	0.77	x	4.2	x	9.21	x	0.45	x	0.7	=	8.45	(75)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	4.2	x	36.79	x	0.45	x	0.7	=	33.73	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	4.2	x	62.67	x	0.45	x	0.7	=	57.46	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	4.2	x	85.75	x	0.45	x	0.7	=	78.62	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	4.2	x	106.25	x	0.45	x	0.7	=	97.42	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	4.2	x	119.01	x	0.45	x	0.7	=	109.11	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	4.2	x	118.15	x	0.45	x	0.7	=	108.32	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	4.2	x	113.91	x	0.45	x	0.7	=	104.44	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	4.2	x	104.39	x	0.45	x	0.7	=	95.71	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)

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Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	4.2	x	92.85	x	0.45	x	0.7	=	85.13	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	4.2	x	69.27	x	0.45	x	0.7	=	63.51	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	4.2	x	44.07	x	0.45	x	0.7	=	40.41	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	4.2	x	31.49	x	0.45	x	0.7	=	28.87	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southwest	0.9x	0.77	x	4.2	x	36.79		0.45	x	0.7	=	33.73	(79)
Southwest	0.9x	0.77	x	4.2	x	62.67		0.45	x	0.7	=	57.46	(79)
Southwest	0.9x	0.77	x	4.2	x	85.75		0.45	x	0.7	=	78.62	(79)
Southwest	0.9x	0.77	x	4.2	x	106.25		0.45	x	0.7	=	97.42	(79)
Southwest	0.9x	0.77	x	4.2	x	119.01		0.45	x	0.7	=	109.11	(79)
Southwest	0.9x	0.77	x	4.2	x	118.15		0.45	x	0.7	=	108.32	(79)
Southwest	0.9x	0.77	x	4.2	x	113.91		0.45	x	0.7	=	104.44	(79)
Southwest	0.9x	0.77	x	4.2	x	104.39		0.45	x	0.7	=	95.71	(79)
Southwest	0.9x	0.77	x	4.2	x	92.85		0.45	x	0.7	=	85.13	(79)
Southwest	0.9x	0.77	x	4.2	x	69.27		0.45	x	0.7	=	63.51	(79)
Southwest	0.9x	0.77	x	4.2	x	44.07		0.45	x	0.7	=	40.41	(79)
Southwest	0.9x	0.77	x	4.2	x	31.49		0.45	x	0.7	=	28.87	(79)

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

(83)m=	149.44	262.34	379.61	504.99	597.25	606.84	579.27	508.31	422.69	295.51	180.42	126.98	(83)

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

(84)m=	595.83	706.61	809.69	912.12	980.96	968.03	925.85	861.02	787.2	683.19	594.75	561.4	(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=	0.95	0.93	0.88	0.8	0.67	0.52	0.39	0.43	0.64	0.84	0.93	0.96	(86)

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

(87)m=	19	19.3	19.74	20.26	20.65	20.88	20.96	20.95	20.78	20.26	19.54	18.94	(87)

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

(88)m=	20.06	20.06	20.06	20.07	20.08	20.09	20.09	20.09	20.08	20.08	20.07	20.07	(88)

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

(89)m=	0.95	0.92	0.86	0.77	0.63	0.46	0.32	0.36	0.58	0.81	0.92	0.95	(89)

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

(90)m=	17.38	17.82	18.44	19.17	19.69	19.98	20.06	20.05	19.86	19.18	18.17	17.31	(90)

fLA = Living area ÷ (4) = 0.34 (91)

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

(92)m=	17.93	18.33	18.89	19.54	20.02	20.29	20.37	20.36	20.18	19.55	18.64	17.87	(92)

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

(93)m=	17.93	18.33	18.89	19.54	20.02	20.29	20.37	20.36	20.18	19.55	18.64	17.87	(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=	0.93	0.89	0.84	0.75	0.63	0.47	0.34	0.38	0.58	0.79	0.9	0.94	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	552.63	631.62	680.82	684.81	613.25	456.72	316.95	328.27	459.57	540.03	533.44	525.47	(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=	1231.51	1209.61	1112.8	942.31	734.45	495.12	328.03	343.53	532.05	790.38	1024.94	1220.77	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	505.09	388.41	321.39	185.4	90.17	0	0	0	0	186.26	353.88	517.31	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2547.91 (98)

Space heating requirement in kWh/m²/year 29.12 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2547.91	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3057.49	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

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Water heating

Annual water heating requirement		2156.8	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2588.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	56.46	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		176.82	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	176.82	(331)
Energy for lighting (calculated in Appendix L)		369.08	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5461.48	(338)

12b. CO_2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1408.7	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	29.3	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1438	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1438	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	91.77	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	191.55	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				1342.42	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.34	(384)
EI rating (section 14)					86.42	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block T - Mid Floor

Address : T, Block T, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	87.51	(1a)	x	2.5	(2a)	=	218.78	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.51	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			218.78	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Windows Type 2			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Windows Type 3			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 4			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 5			4.2	x1/[1/(1.2)+ 0.04]		=	4.81			(27)
Windows Type 6			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 7			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 8			4.2	x1/[1/(1.2)+ 0.04]		=	4.81			(27)
Windows Type 9			4.2	x1/[1/(1.2)+ 0.04]		=	4.81			(27)
Walls Type1	65.55	25.2	40.35	x	0.16	=	6.46			(29)
Walls Type2	53.95	1.91	52.04	x	0.15	=	7.83			(29)
Total area of elements, m²			119.5							(31)
Party floor			87.51							(32a)
Party ceiling			87.51							(32b)

** 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) =	45.05	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	6957.21	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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 — 10.87 (36)

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

Total fabric heat loss — (33) + (36) = 55.92 (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=	21.37	21.12	20.86	19.6	19.35	18.09	18.09	17.83	18.59	19.35	19.85	20.36	(38)

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

(39)m=	77.29	77.03	76.78	75.52	75.27	74	74	73.75	74.51	75.27	75.77	76.28	

Average = $Sum(39)_{1...12}$ /12= 75.46 (39)

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

(40)m=	0.88	0.88	0.88	0.86	0.86	0.85	0.85	0.84	0.85	0.86	0.87	0.87	

Average = $Sum(40)_{1...12}$ /12= 0.86 (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 — 2.59 (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 — 95.71 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	105.29	101.46	97.63	93.8	89.97	86.14	86.14	89.97	93.8	97.63	101.46	105.29

Total = $Sum(44)_{1...12}$ = 1148.57 (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=	156.14	136.56	140.92	122.85	117.88	101.72	94.26	108.17	109.46	127.56	139.24	151.21

Total = $Sum(45)_{1...12}$ = 1505.96 (45)

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

(46)m=	23.42	20.48	21.14	18.43	17.68	15.26	14.14	16.22	16.42	19.13	20.89	22.68	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.03	(54)
Enter (50) or (54) in (55)		1.03	(55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	211.41	186.48	196.19	176.35	173.16	155.22	149.54	163.44	162.95	182.84	192.74	206.49	(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=	211.41	186.48	196.19	176.35	173.16	155.22	149.54	163.44	162.95	182.84	192.74	206.49	

Output from water heater (annual)1…12 | 2156.8 | (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=	96.14	85.35	91.08	83.64	83.42	76.62	75.56	80.19	79.19	86.64	89.09	94.5	(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=	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	(66)

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

(67)m=	20.9	18.56	15.1	11.43	8.54	7.21	7.79	10.13	13.6	17.26	20.15	21.48	(67)

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

(68)m=	234.42	236.85	230.72	217.67	201.2	185.72	175.37	172.94	179.07	192.12	208.6	224.08	(68)

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

(69)m=	35.95	35.95	35.95	35.95	35.95	35.95	35.95	35.95	35.95	35.95	35.95	35.95	(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=	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	-103.6	(71)

Water heating gains (Table 5)

(72)m=	129.22	127	122.41	116.17	112.12	106.41	101.56	107.78	109.99	116.45	123.74	127.01	(72)

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

(73)m=	446.39	444.27	430.08	407.13	383.71	361.19	346.58	352.7	364.51	387.68	414.34	434.42	(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)	
Northeast	0.9x	0.77	x	1.44	x	11.28	x	0.45	x	0.7	=	3.55	(75)
Northeast	0.9x	0.77	x	1.44	x	11.28	x	0.45	x	0.7	=	3.55	(75)
Northeast	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(75)
Northeast	0.9x	0.77	x	4.2	x	11.28	x	0.45	x	0.7	=	10.34	(75)
Northeast	0.9x	0.77	x	1.44	x	22.97	x	0.45	x	0.7	=	7.22	(75)
Northeast	0.9x	0.77	x	1.44	x	22.97	x	0.45	x	0.7	=	7.22	(75)
Northeast	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(75)
Northeast	0.9x	0.77	x	4.2	x	22.97	x	0.45	x	0.7	=	21.06	(75)
Northeast	0.9x	0.77	x	1.44	x	41.38	x	0.45	x	0.7	=	13.01	(75)
Northeast	0.9x	0.77	x	1.44	x	41.38	x	0.45	x	0.7	=	13.01	(75)
Northeast	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(75)
Northeast	0.9x	0.77	x	4.2	x	41.38	x	0.45	x	0.7	=	37.94	(75)
Northeast	0.9x	0.77	x	1.44	x	67.96	x	0.45	x	0.7	=	21.36	(75)
Northeast	0.9x	0.77	x	1.44	x	67.96	x	0.45	x	0.7	=	21.36	(75)
Northeast	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(75)
Northeast	0.9x	0.77	x	4.2	x	67.96	x	0.45	x	0.7	=	62.3	(75)
Northeast	0.9x	0.77	x	1.44	x	91.35	x	0.45	x	0.7	=	28.71	(75)
Northeast	0.9x	0.77	x	1.44	x	91.35	x	0.45	x	0.7	=	28.71	(75)
Northeast	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(75)
Northeast	0.9x	0.77	x	4.2	x	91.35	x	0.45	x	0.7	=	83.75	(75)
Northeast	0.9x	0.77	x	1.44	x	97.38	x	0.45	x	0.7	=	30.61	(75)
Northeast	0.9x	0.77	x	1.44	x	97.38	x	0.45	x	0.7	=	30.61	(75)
Northeast	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(75)
Northeast	0.9x	0.77	x	4.2	x	97.38	x	0.45	x	0.7	=	89.29	(75)
Northeast	0.9x	0.77	x	1.44	x	91.1	x	0.45	x	0.7	=	28.64	(75)
Northeast	0.9x	0.77	x	1.44	x	91.1	x	0.45	x	0.7	=	28.64	(75)
Northeast	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(75)
Northeast	0.9x	0.77	x	4.2	x	91.1	x	0.45	x	0.7	=	83.53	(75)
Northeast	0.9x	0.77	x	1.44	x	72.63	x	0.45	x	0.7	=	22.83	(75)
Northeast	0.9x	0.77	x	1.44	x	72.63	x	0.45	x	0.7	=	22.83	(75)
Northeast	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(75)
Northeast	0.9x	0.77	x	4.2	x	72.63	x	0.45	x	0.7	=	66.59	(75)
Northeast	0.9x	0.77	x	1.44	x	50.42	x	0.45	x	0.7	=	15.85	(75)
Northeast	0.9x	0.77	x	1.44	x	50.42	x	0.45	x	0.7	=	15.85	(75)
Northeast	0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(75)
Northeast	0.9x	0.77	x	4.2	x	50.42	x	0.45	x	0.7	=	46.23	(75)
Northeast	0.9x	0.77	x	1.44	x	28.07	x	0.45	x	0.7	=	8.82	(75)
Northeast	0.9x	0.77	x	1.44	x	28.07	x	0.45	x	0.7	=	8.82	(75)
Northeast	0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(75)

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Northeast	0.9x	0.77	x	4.2	x	28.07	x	0.45	x	0.7	=	25.73	(75)
Northeast	0.9x	0.77	x	1.44	x	14.2	x	0.45	x	0.7	=	4.46	(75)
Northeast	0.9x	0.77	x	1.44	x	14.2	x	0.45	x	0.7	=	4.46	(75)
Northeast	0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(75)
Northeast	0.9x	0.77	x	4.2	x	14.2	x	0.45	x	0.7	=	13.02	(75)
Northeast	0.9x	0.77	x	1.44	x	9.21	x	0.45	x	0.7	=	2.9	(75)
Northeast	0.9x	0.77	x	1.44	x	9.21	x	0.45	x	0.7	=	2.9	(75)
Northeast	0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(75)
Northeast	0.9x	0.77	x	4.2	x	9.21	x	0.45	x	0.7	=	8.45	(75)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	4.2	x	36.79	x	0.45	x	0.7	=	33.73	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	4.2	x	62.67	x	0.45	x	0.7	=	57.46	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	4.2	x	85.75	x	0.45	x	0.7	=	78.62	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	4.2	x	106.25	x	0.45	x	0.7	=	97.42	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	4.2	x	119.01	x	0.45	x	0.7	=	109.11	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	4.2	x	118.15	x	0.45	x	0.7	=	108.32	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	4.2	x	113.91	x	0.45	x	0.7	=	104.44	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	4.2	x	104.39	x	0.45	x	0.7	=	95.71	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)

Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	4.2	x	92.85	x	0.45	x	0.7	=	85.13	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	4.2	x	69.27	x	0.45	x	0.7	=	63.51	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	4.2	x	44.07	x	0.45	x	0.7	=	40.41	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	4.2	x	31.49	x	0.45	x	0.7	=	28.87	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southwest	0.9x	0.77	x	4.2	x	36.79		0.45	x	0.7	=	33.73	(79)
Southwest	0.9x	0.77	x	4.2	x	62.67		0.45	x	0.7	=	57.46	(79)
Southwest	0.9x	0.77	x	4.2	x	85.75		0.45	x	0.7	=	78.62	(79)
Southwest	0.9x	0.77	x	4.2	x	106.25		0.45	x	0.7	=	97.42	(79)
Southwest	0.9x	0.77	x	4.2	x	119.01		0.45	x	0.7	=	109.11	(79)
Southwest	0.9x	0.77	x	4.2	x	118.15		0.45	x	0.7	=	108.32	(79)
Southwest	0.9x	0.77	x	4.2	x	113.91		0.45	x	0.7	=	104.44	(79)
Southwest	0.9x	0.77	x	4.2	x	104.39		0.45	x	0.7	=	95.71	(79)
Southwest	0.9x	0.77	x	4.2	x	92.85		0.45	x	0.7	=	85.13	(79)
Southwest	0.9x	0.77	x	4.2	x	69.27		0.45	x	0.7	=	63.51	(79)
Southwest	0.9x	0.77	x	4.2	x	44.07		0.45	x	0.7	=	40.41	(79)
Southwest	0.9x	0.77	x	4.2	x	31.49		0.45	x	0.7	=	28.87	(79)

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

(83)m=	149.44	262.34	379.61	504.99	597.25	606.84	579.27	508.31	422.69	295.51	180.42	126.98	(83)

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

(84)m=	595.83	706.61	809.69	912.12	980.96	968.03	925.85	861.02	787.2	683.19	594.75	561.4	(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=	0.95	0.92	0.86	0.76	0.62	0.46	0.34	0.38	0.58	0.81	0.92	0.96	(86)

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

(87)m=	19.37	19.67	20.06	20.5	20.79	20.94	20.98	20.98	20.87	20.48	19.85	19.32	(87)

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

(88)m=	20.18	20.18	20.19	20.2	20.2	20.21	20.21	20.22	20.21	20.2	20.2	20.19	(88)

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

(89)m=	0.94	0.91	0.84	0.73	0.58	0.41	0.28	0.32	0.53	0.78	0.91	0.95	(89)

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

(90)m=	17.99	18.41	18.98	19.59	19.97	20.16	20.2	20.2	20.08	19.57	18.7	17.92	(90)

fLA = Living area ÷ (4) = 0.34 (91)

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

(92)m=	18.46	18.84	19.35	19.9	20.25	20.43	20.47	20.46	20.35	19.88	19.09	18.4	(92)

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

(93)m=	18.46	18.84	19.35	19.9	20.25	20.43	20.47	20.46	20.35	19.88	19.09	18.4	(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=	0.92	0.89	0.83	0.72	0.58	0.43	0.3	0.34	0.54	0.77	0.89	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	550.79	626.28	668.47	658.68	572.67	412.4	281.58	292.95	425.44	524.39	529.07	524.22	(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=	1094.32	1073.98	986.42	830.54	643.59	431.15	286.29	299.73	465.96	698.5	908.73	1082.96	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	404.39	300.85	236.56	123.74	52.77	0	0	0	0	129.54	273.36	415.7	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1936.89 (98)

Space heating requirement in kWh/m²/year 22.13 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1936.89	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2324.27	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

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Water heating

Annual water heating requirement		2156.8	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2588.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	49.12	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		176.82	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	176.82	(331)
Energy for lighting (calculated in Appendix L)		369.08	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4728.26	(338)

12b. CO_2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1225.75	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.5	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1251.24	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1251.24	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	91.77	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	191.55	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				1155.66	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				13.21	(384)
EI rating (section 14)					88.31	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block U - Ground Floor

Address : U, Block U, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.17	(1a) x	2.5	(2a) =	192.92	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.17	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	192.92	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			1.3	x1/[1/(1.2)+ 0.04]		=	1.49			(27)
Windows Type 2			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 3			8.4	x1/[1/(1.2)+ 0.04]		=	9.62			(27)
Windows Type 4			6.12	x1/[1/(1.2)+ 0.04]		=	7.01			(27)
Floor			77.17	x	0.1	=	7.717			(28)
Walls Type1	43.28	18.25	25.03	x	0.16	=	4			(29)
Walls Type2	28.8	1.91	26.89	x	0.15	=	4.04			(29)
Total area of elements, m²			149.24							(31)
Party wall			19.67	x	0	=	0			(32)
Party ceiling			77.17							(32b)

** 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) = 38.57 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12156.41 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 12.51 (36)

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

Total fabric heat loss (33) + (36) = 51.08 (37)

DER WorkSheet: New dwelling design stage

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=	18.84	18.62	18.4	17.29	17.06	15.95	15.95	15.73	16.39	17.06	17.51	17.95	(38)

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

(39)m=	69.93	69.7	69.48	68.37	68.14	67.03	67.03	66.81	67.48	68.14	68.59	69.04	

Average = $\text{Sum}(39)_{1...12}$ /12= 68.31 (39)

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

(40)m=	0.91	0.9	0.9	0.89	0.88	0.87	0.87	0.87	0.87	0.88	0.89	0.89	

Average = $\text{Sum}(40)_{1...12}$ /12= 0.89 (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 2.41 (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 91.37 (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=	100.5	96.85	93.19	89.54	85.88	82.23	82.23	85.88	89.54	93.19	96.85	100.5	

Total = $\text{Sum}(44)_{1...12}$ = 1096.39 (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=	149.04	130.35	134.51	117.27	112.52	97.1	89.98	103.25	104.48	121.77	132.92	144.34	

Total = $\text{Sum}(45)_{1...12}$ = 1437.54 (45)

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

(46)m=	22.36	19.55	20.18	17.59	16.88	14.57	13.5	15.49	15.67	18.26	19.94	21.65	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	204.32	180.28	189.79	170.76	167.8	150.59	145.25	158.53	157.98	177.04	186.41	199.62	(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=	204.32	180.28	189.79	170.76	167.8	150.59	145.25	158.53	157.98	177.04	186.41	199.62

Output from water heater (annual)$_{1...12}$ — 2088.38 (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=	93.78	83.28	88.95	81.79	81.64	75.08	74.14	78.55	77.54	84.71	86.99	92.21	(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=	120.35	120.35	120.35	120.35	120.35	120.35	120.35	120.35	120.35	120.35	120.35	120.35	(66)

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

(67)m=	19.03	16.9	13.74	10.4	7.78	6.57	7.1	9.22	12.38	15.72	18.34	19.56	(67)

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

(68)m=	213.42	215.64	210.06	198.18	183.18	169.08	159.67	157.45	163.03	174.91	189.91	204.01	(68)

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

(69)m=	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	(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=	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	(71)

Water heating gains (Table 5)

(72)m=	126.05	123.93	119.55	113.59	109.73	104.28	99.65	105.58	107.69	113.86	120.82	123.94	(72)

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

(73)m=	417.6	415.58	402.46	381.28	359.79	339.03	325.52	331.36	342.2	363.59	388.18	406.61	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast 0.9x	0.77	x	8.4	x	11.28	x	0.45	x	0.7	=	20.69	(75)
Northeast 0.9x	0.77	x	6.12	x	11.28	x	0.45	x	0.7	=	15.07	(75)
Northeast 0.9x	0.77	x	8.4	x	22.97	x	0.45	x	0.7	=	42.11	(75)
Northeast 0.9x	0.77	x	6.12	x	22.97	x	0.45	x	0.7	=	30.68	(75)
Northeast 0.9x	0.77	x	8.4	x	41.38	x	0.45	x	0.7	=	75.88	(75)
Northeast 0.9x	0.77	x	6.12	x	41.38	x	0.45	x	0.7	=	55.28	(75)
Northeast 0.9x	0.77	x	8.4	x	67.96	x	0.45	x	0.7	=	124.61	(75)
Northeast 0.9x	0.77	x	6.12	x	67.96	x	0.45	x	0.7	=	90.79	(75)
Northeast 0.9x	0.77	x	8.4	x	91.35	x	0.45	x	0.7	=	167.5	(75)
Northeast 0.9x	0.77	x	6.12	x	91.35	x	0.45	x	0.7	=	122.04	(75)
Northeast 0.9x	0.77	x	8.4	x	97.38	x	0.45	x	0.7	=	178.57	(75)
Northeast 0.9x	0.77	x	6.12	x	97.38	x	0.45	x	0.7	=	130.1	(75)
Northeast 0.9x	0.77	x	8.4	x	91.1	x	0.45	x	0.7	=	167.05	(75)
Northeast 0.9x	0.77	x	6.12	x	91.1	x	0.45	x	0.7	=	121.71	(75)
Northeast 0.9x	0.77	x	8.4	x	72.63	x	0.45	x	0.7	=	133.17	(75)
Northeast 0.9x	0.77	x	6.12	x	72.63	x	0.45	x	0.7	=	97.03	(75)
Northeast 0.9x	0.77	x	8.4	x	50.42	x	0.45	x	0.7	=	92.46	(75)
Northeast 0.9x	0.77	x	6.12	x	50.42	x	0.45	x	0.7	=	67.36	(75)
Northeast 0.9x	0.77	x	8.4	x	28.07	x	0.45	x	0.7	=	51.47	(75)
Northeast 0.9x	0.77	x	6.12	x	28.07	x	0.45	x	0.7	=	37.5	(75)
Northeast 0.9x	0.77	x	8.4	x	14.2	x	0.45	x	0.7	=	26.03	(75)
Northeast 0.9x	0.77	x	6.12	x	14.2	x	0.45	x	0.7	=	18.97	(75)
Northeast 0.9x	0.77	x	8.4	x	9.21	x	0.45	x	0.7	=	16.9	(75)
Northeast 0.9x	0.77	x	6.12	x	9.21	x	0.45	x	0.7	=	12.31	(75)
Northwest 0.9x	0.77	x	1.3	x	11.28	x	0.45	x	0.7	=	3.2	(81)
Northwest 0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest 0.9x	0.77	x	1.3	x	22.97	x	0.45	x	0.7	=	6.52	(81)
Northwest 0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest 0.9x	0.77	x	1.3	x	41.38	x	0.45	x	0.7	=	11.74	(81)
Northwest 0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest 0.9x	0.77	x	1.3	x	67.96	x	0.45	x	0.7	=	19.28	(81)
Northwest 0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest 0.9x	0.77	x	1.3	x	91.35	x	0.45	x	0.7	=	25.92	(81)
Northwest 0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest 0.9x	0.77	x	1.3	x	97.38	x	0.45	x	0.7	=	27.64	(81)
Northwest 0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest 0.9x	0.77	x	1.3	x	91.1	x	0.45	x	0.7	=	25.85	(81)
Northwest 0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest 0.9x	0.77	x	1.3	x	72.63	x	0.45	x	0.7	=	20.61	(81)
Northwest 0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest 0.9x	0.77	x	1.3	x	50.42	x	0.45	x	0.7	=	14.31	(81)

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Northwest 0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest 0.9x	0.77	x	1.3	x	28.07	x	0.45	x	0.7	=	7.97	(81)
Northwest 0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest 0.9x	0.77	x	1.3	x	14.2	x	0.45	x	0.7	=	4.03	(81)
Northwest 0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest 0.9x	0.77	x	1.3	x	9.21	x	0.45	x	0.7	=	2.61	(81)
Northwest 0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)

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

(83)m=	44.95	91.5	164.85	270.73	363.91	387.97	362.94	289.34	200.87	111.82	56.56	36.71	(83)

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

(84)m=	462.55	507.07	567.31	652.01	723.7	727	688.45	620.7	543.07	475.41	444.74	443.32	(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=	0.96	0.95	0.92	0.84	0.7	0.54	0.41	0.47	0.7	0.88	0.95	0.97	(86)
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)													
(87)m=	19.17	19.38	19.76	20.28	20.68	20.9	20.97	20.95	20.78	20.26	19.65	19.14	(87)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)													
(88)m=	20.16	20.16	20.17	20.18	20.18	20.19	20.19	20.2	20.19	20.18	20.18	20.17	(88)
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)													
(89)m=	0.96	0.94	0.9	0.81	0.67	0.48	0.34	0.39	0.64	0.86	0.94	0.96	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m=	17.7	17.99	18.55	19.28	19.82	20.1	20.17	20.16	19.96	19.27	18.39	17.66	(90)

fLA = Living area ÷ (4) = 0.28 (91)

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

(92)m=	18.11	18.38	18.89	19.56	20.06	20.33	20.39	20.38	20.19	19.55	18.74	18.07	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m=	18.11	18.38	18.89	19.56	20.06	20.33	20.39	20.38	20.19	19.55	18.74	18.07	(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=	0.94	0.92	0.88	0.8	0.66	0.49	0.36	0.41	0.64	0.84	0.92	0.95	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	435.52	468.31	501	518.94	477.29	357.41	247.13	255.11	349.43	399.58	409.03	419.92	(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=	965.54	939.5	860.68	728.98	569.82	383.8	254.33	266.08	410.73	609.66	798.36	957.68	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	394.34	316.64	267.6	151.23	68.85	0	0	0	0	156.29	280.31	400.09	

DER WorkSheet: New dwelling design stage

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2035.36	(98)
Space heating requirement in kWh/m²/year		26.37	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2035.36	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2442.43	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2088.38	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2506.05	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	49.48	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		147.11	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	147.11	(331)
Energy for lighting (calculated in Appendix L)		336.02	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4701.53	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1234.74	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.68	(372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1260.42	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1260.42	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	76.35	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	174.4	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =			1132.26	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.67	(384)
EI rating (section 14)				87.58	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block U - Mid Floor

Address : U, Block U, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.17	(1a) x	2.5	(2a) =	192.92	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.17	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	192.92	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			1.3	x1/[1/(1.2)+ 0.04]		=	1.49			(27)
Windows Type 2			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 3			8.4	x1/[1/(1.2)+ 0.04]		=	9.62			(27)
Windows Type 4			6.12	x1/[1/(1.2)+ 0.04]		=	7.01			(27)
Walls Type1	43.28	18.25	25.03	x	0.16	=	4			(29)
Walls Type2	28.8	1.91	26.89	x	0.15	=	4.04			(29)
Total area of elements, m²			72.08							(31)
Party wall			19.67	x	0	=	0			(32)
Party floor			77.17							(32a)
Party ceiling			77.17							(32b)

** 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) = 30.85 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6754.51 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 7.95 (36)

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

Total fabric heat loss (33) + (36) = 38.8 (37)

DER WorkSheet: New dwelling design stage

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=	18.84	18.62	18.4	17.29	17.06	15.95	15.95	15.73	16.39	17.06	17.51	17.95	(38)

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

(39)m=	57.65	57.42	57.2	56.09	55.86	54.75	54.75	54.53	55.19	55.86	56.31	56.75	

Average = Sum(39)$_{1...12}$ /12= 56.03 (39)

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

(40)m=	0.75	0.74	0.74	0.73	0.72	0.71	0.71	0.71	0.72	0.72	0.73	0.74	

Average = Sum(40)$_{1...12}$ /12= 0.73 (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 2.41 (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 91.37 (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=	100.5	96.85	93.19	89.54	85.88	82.23	82.23	85.88	89.54	93.19	96.85	100.5	

Total = Sum(44)$_{1...12}$ = 1096.39 (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=	149.04	130.35	134.51	117.27	112.52	97.1	89.98	103.25	104.48	121.77	132.92	144.34	

Total = Sum(45)$_{1...12}$ = 1437.54 (45)

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

(46)m=	22.36	19.55	20.18	17.59	16.88	14.57	13.5	15.49	15.67	18.26	19.94	21.65	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	204.32	180.28	189.79	170.76	167.8	150.59	145.25	158.53	157.98	177.04	186.41	199.62	(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=	204.32	180.28	189.79	170.76	167.8	150.59	145.25	158.53	157.98	177.04	186.41	199.62

Output from water heater (annual)$_{1...12}$ | 2088.38 | (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=	93.78	83.28	88.95	81.79	81.64	75.08	74.14	78.55	77.54	84.71	86.99	92.21	(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=	120.35	120.35	120.35	120.35	120.35	120.35	120.35	120.35	120.35	120.35	120.35	120.35	(66)

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

(67)m=	19.03	16.9	13.74	10.4	7.78	6.57	7.1	9.22	12.38	15.72	18.34	19.56	(67)

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

(68)m=	213.42	215.64	210.06	198.18	183.18	169.08	159.67	157.45	163.03	174.91	189.91	204.01	(68)

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

(69)m=	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	(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=	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	-96.28	(71)

Water heating gains (Table 5)

(72)m=	126.05	123.93	119.55	113.59	109.73	104.28	99.65	105.58	107.69	113.86	120.82	123.94	(72)

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

(73)m=	417.6	415.58	402.46	381.28	359.79	339.03	325.52	331.36	342.2	363.59	388.18	406.61	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	8.4	x	11.28	x	0.45	x	0.7	=	20.69	(75)
Northeast	0.9x	0.77	x	6.12	x	11.28	x	0.45	x	0.7	=	15.07	(75)
Northeast	0.9x	0.77	x	8.4	x	22.97	x	0.45	x	0.7	=	42.11	(75)
Northeast	0.9x	0.77	x	6.12	x	22.97	x	0.45	x	0.7	=	30.68	(75)
Northeast	0.9x	0.77	x	8.4	x	41.38	x	0.45	x	0.7	=	75.88	(75)
Northeast	0.9x	0.77	x	6.12	x	41.38	x	0.45	x	0.7	=	55.28	(75)
Northeast	0.9x	0.77	x	8.4	x	67.96	x	0.45	x	0.7	=	124.61	(75)
Northeast	0.9x	0.77	x	6.12	x	67.96	x	0.45	x	0.7	=	90.79	(75)
Northeast	0.9x	0.77	x	8.4	x	91.35	x	0.45	x	0.7	=	167.5	(75)
Northeast	0.9x	0.77	x	6.12	x	91.35	x	0.45	x	0.7	=	122.04	(75)
Northeast	0.9x	0.77	x	8.4	x	97.38	x	0.45	x	0.7	=	178.57	(75)
Northeast	0.9x	0.77	x	6.12	x	97.38	x	0.45	x	0.7	=	130.1	(75)
Northeast	0.9x	0.77	x	8.4	x	91.1	x	0.45	x	0.7	=	167.05	(75)
Northeast	0.9x	0.77	x	6.12	x	91.1	x	0.45	x	0.7	=	121.71	(75)
Northeast	0.9x	0.77	x	8.4	x	72.63	x	0.45	x	0.7	=	133.17	(75)
Northeast	0.9x	0.77	x	6.12	x	72.63	x	0.45	x	0.7	=	97.03	(75)
Northeast	0.9x	0.77	x	8.4	x	50.42	x	0.45	x	0.7	=	92.46	(75)
Northeast	0.9x	0.77	x	6.12	x	50.42	x	0.45	x	0.7	=	67.36	(75)
Northeast	0.9x	0.77	x	8.4	x	28.07	x	0.45	x	0.7	=	51.47	(75)
Northeast	0.9x	0.77	x	6.12	x	28.07	x	0.45	x	0.7	=	37.5	(75)
Northeast	0.9x	0.77	x	8.4	x	14.2	x	0.45	x	0.7	=	26.03	(75)
Northeast	0.9x	0.77	x	6.12	x	14.2	x	0.45	x	0.7	=	18.97	(75)
Northeast	0.9x	0.77	x	8.4	x	9.21	x	0.45	x	0.7	=	16.9	(75)
Northeast	0.9x	0.77	x	6.12	x	9.21	x	0.45	x	0.7	=	12.31	(75)
Northwest	0.9x	0.77	x	1.3	x	11.28	x	0.45	x	0.7	=	3.2	(81)
Northwest	0.9x	0.77	x	2.43	x	11.28	x	0.45	x	0.7	=	5.99	(81)
Northwest	0.9x	0.77	x	1.3	x	22.97	x	0.45	x	0.7	=	6.52	(81)
Northwest	0.9x	0.77	x	2.43	x	22.97	x	0.45	x	0.7	=	12.18	(81)
Northwest	0.9x	0.77	x	1.3	x	41.38	x	0.45	x	0.7	=	11.74	(81)
Northwest	0.9x	0.77	x	2.43	x	41.38	x	0.45	x	0.7	=	21.95	(81)
Northwest	0.9x	0.77	x	1.3	x	67.96	x	0.45	x	0.7	=	19.28	(81)
Northwest	0.9x	0.77	x	2.43	x	67.96	x	0.45	x	0.7	=	36.05	(81)
Northwest	0.9x	0.77	x	1.3	x	91.35	x	0.45	x	0.7	=	25.92	(81)
Northwest	0.9x	0.77	x	2.43	x	91.35	x	0.45	x	0.7	=	48.46	(81)
Northwest	0.9x	0.77	x	1.3	x	97.38	x	0.45	x	0.7	=	27.64	(81)
Northwest	0.9x	0.77	x	2.43	x	97.38	x	0.45	x	0.7	=	51.66	(81)
Northwest	0.9x	0.77	x	1.3	x	91.1	x	0.45	x	0.7	=	25.85	(81)
Northwest	0.9x	0.77	x	2.43	x	91.1	x	0.45	x	0.7	=	48.33	(81)
Northwest	0.9x	0.77	x	1.3	x	72.63	x	0.45	x	0.7	=	20.61	(81)
Northwest	0.9x	0.77	x	2.43	x	72.63	x	0.45	x	0.7	=	38.53	(81)
Northwest	0.9x	0.77	x	1.3	x	50.42	x	0.45	x	0.7	=	14.31	(81)

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Northwest 0.9x	0.77	x	2.43	x	50.42	x	0.45	x	0.7	=	26.75	(81)
Northwest 0.9x	0.77	x	1.3	x	28.07	x	0.45	x	0.7	=	7.97	(81)
Northwest 0.9x	0.77	x	2.43	x	28.07	x	0.45	x	0.7	=	14.89	(81)
Northwest 0.9x	0.77	x	1.3	x	14.2	x	0.45	x	0.7	=	4.03	(81)
Northwest 0.9x	0.77	x	2.43	x	14.2	x	0.45	x	0.7	=	7.53	(81)
Northwest 0.9x	0.77	x	1.3	x	9.21	x	0.45	x	0.7	=	2.61	(81)
Northwest 0.9x	0.77	x	2.43	x	9.21	x	0.45	x	0.7	=	4.89	(81)

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

(83)m=	44.95	91.5	164.85	270.73	363.91	387.97	362.94	289.34	200.87	111.82	56.56	36.71	(83)

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

(84)m=	462.55	507.07	567.31	652.01	723.7	727	688.45	620.7	543.07	475.41	444.74	443.32	(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=	0.96	0.94	0.9	0.8	0.64	0.46	0.34	0.39	0.63	0.85	0.94	0.96	(86)

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

(87)m=	19.6	19.79	20.14	20.57	20.84	20.96	20.99	20.98	20.89	20.52	20.01	19.58	(87)

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

(88)m=	20.3	20.3	20.3	20.32	20.32	20.33	20.33	20.34	20.33	20.32	20.31	20.31	(88)

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

(89)m=	0.95	0.93	0.89	0.77	0.6	0.42	0.29	0.34	0.58	0.83	0.93	0.96	(89)

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

(90)m=	18.4	18.68	19.17	19.78	20.14	20.3	20.33	20.32	20.22	19.73	19	18.37	(90)

fLA = Living area ÷ (4) = 0.28 (91)

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

(92)m=	18.74	18.99	19.44	20	20.34	20.48	20.51	20.51	20.4	19.95	19.28	18.71	(92)

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

(93)m=	18.74	18.99	19.44	20	20.34	20.48	20.51	20.51	20.4	19.95	19.28	18.71	(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=	0.94	0.92	0.87	0.76	0.6	0.43	0.31	0.36	0.59	0.82	0.91	0.94	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	433.86	464.81	492.42	496.57	437.38	312.37	211.93	220.36	318.92	387.82	405.47	418.64	(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=	832.18	809.11	740.15	622.33	482.5	322.09	214.11	223.96	347.99	522.29	685.88	823.35	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	296.36	231.37	184.31	90.55	33.57	0	0	0	0	100.05	201.89	301.11	

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1439.2	(98)
Space heating requirement in kWh/m²/year		18.65	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1439.2	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1727.04	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2088.38	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2506.05	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.33	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		147.11	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	147.11	(331)
Energy for lighting (calculated in Appendix L)		336.02	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3986.14	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1056.24	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.97	(372)

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Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1078.21	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1078.21	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	76.35	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	174.4	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =			950.04	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			12.31	(384)
EI rating (section 14)				89.58	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block V - Ground Floor

Address : V, Block V, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.27	(1a) x	2.5	(2a) =	125.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.27	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	125.68	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 2			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Windows Type 3			6	x1/[1/(1.2)+ 0.04]		=	6.87			(27)
Floor			50.27	x	0.1	=	5.027			(28)
Walls Type1	30.1	9.87	20.23	x	0.16	=	3.24			(29)
Walls Type2	35.78	1.91	33.87	x	0.15	=	5.09			(29)
Total area of elements, m²			116.15							(31)
Party wall			10.85	x	0	=	0			(32)
Party ceiling			50.27							(32b)

** 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) =	26.57	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	8012.91	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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		8.74	(36)
if details of thermal bridging are not known (36) = 0.05 x (31)			
Total fabric heat loss	(33) + (36) =	35.3	(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

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(38)m=	12.28	12.13	11.99	11.26	11.11	10.39	10.39	10.24	10.68	11.11	11.41	11.7	(38)

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

(39)m=	47.58	47.44	47.29	46.56	46.42	45.69	45.69	45.55	45.98	46.42	46.71	47	

Average = $Sum(39)_{1...12}$ /12= 46.53 (39)

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

(40)m=	0.95	0.94	0.94	0.93	0.92	0.91	0.91	0.91	0.91	0.92	0.93	0.93

Average = $Sum(40)_{1...12}$ /12= 0.93 (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 1.7 (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 74.53 (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=	81.98	79	76.02	73.04	70.06	67.08	67.08	70.06	73.04	76.02	79	81.98

Total = $Sum(44)_{1...12}$ = 894.34 (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=	121.58	106.33	109.72	95.66	91.79	79.21	73.4	84.22	85.23	99.33	108.42	117.74

Total = $Sum(45)_{1...12}$ = 1172.63 (45)

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

(46)m=	18.24	15.95	16.46	14.35	13.77	11.88	11.01	12.63	12.78	14.9	16.26	17.66	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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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=	176.85	156.26	165	149.15	147.07	132.7	128.67	139.5	138.72	154.6	161.92	173.02	(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=	176.85	156.26	165	149.15	147.07	132.7	128.67	139.5	138.72	154.6	161.92	173.02

Output from water heater (annual)$_{1...12}$ | 1823.47 | (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=	84.65	75.3	80.7	74.6	74.74	69.13	68.63	72.23	71.13	77.25	78.85	83.37	(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=	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	(66)

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

(67)m=	13.31	11.82	9.61	7.28	5.44	4.59	4.96	6.45	8.66	10.99	12.83	13.68	(67)

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

(68)m=	147.94	149.47	145.6	137.37	126.97	117.2	110.67	109.14	113.01	121.24	131.64	141.41	(68)

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

(69)m=	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	(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=	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	(71)

Water heating gains (Table 5)

(72)m=	113.77	112.05	108.47	103.61	100.46	96.02	92.24	97.08	98.8	103.83	109.51	112.06	(72)

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

(73)m=	323.49	321.81	312.16	296.73	281.34	266.28	256.35	261.14	268.93	284.53	302.45	315.61	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	1.44	x	36.79	x	0.45	x	0.7	=	11.57	(77)

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Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	1.44	x	62.67	x	0.45	x	0.7	=	19.7	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	1.44	x	85.75	x	0.45	x	0.7	=	26.96	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	1.44	x	106.25	x	0.45	x	0.7	=	33.4	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	1.44	x	119.01	x	0.45	x	0.7	=	37.41	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	1.44	x	118.15	x	0.45	x	0.7	=	37.14	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	1.44	x	113.91	x	0.45	x	0.7	=	35.81	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	1.44	x	104.39	x	0.45	x	0.7	=	32.81	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	1.44	x	92.85	x	0.45	x	0.7	=	29.19	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	1.44	x	69.27	x	0.45	x	0.7	=	21.77	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	1.44	x	44.07	x	0.45	x	0.7	=	13.85	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	1.44	x	31.49	x	0.45	x	0.7	=	9.9	(77)
South	0.9x	0.77	x	6	x	46.75	x	0.45	x	0.7	=	61.23	(78)
South	0.9x	0.77	x	6	x	76.57	x	0.45	x	0.7	=	100.29	(78)
South	0.9x	0.77	x	6	x	97.53	x	0.45	x	0.7	=	127.75	(78)
South	0.9x	0.77	x	6	x	110.23	x	0.45	x	0.7	=	144.38	(78)
South	0.9x	0.77	x	6	x	114.87	x	0.45	x	0.7	=	150.45	(78)
South	0.9x	0.77	x	6	x	110.55	x	0.45	x	0.7	=	144.79	(78)
South	0.9x	0.77	x	6	x	108.01	x	0.45	x	0.7	=	141.47	(78)
South	0.9x	0.77	x	6	x	104.89	x	0.45	x	0.7	=	137.39	(78)
South	0.9x	0.77	x	6	x	101.89	x	0.45	x	0.7	=	133.45	(78)
South	0.9x	0.77	x	6	x	82.59	x	0.45	x	0.7	=	108.17	(78)
South	0.9x	0.77	x	6	x	55.42	x	0.45	x	0.7	=	72.58	(78)
South	0.9x	0.77	x	6	x	40.4	x	0.45	x	0.7	=	52.91	(78)

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

(83)m=	92.32	153.23	200.19	234.14	251	244.61	237.7	225.58	211.89	166.69	109.81	79.51	(83)

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

(84)m=	415.8	475.04	512.35	530.87	532.34	510.88	494.05	486.71	480.82	451.22	412.26	395.13	(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

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(86)m=	0.92	0.89	0.84	0.77	0.67	0.52	0.39	0.41	0.58	0.78	0.89	0.93	(86)

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

(87)m=	19.43	19.7	20.03	20.41	20.7	20.9	20.97	20.96	20.85	20.49	19.91	19.38	(87)

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

(88)m=	20.13	20.13	20.13	20.15	20.15	20.16	20.16	20.16	20.15	20.15	20.14	20.14	(88)

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

(89)m=	0.91	0.88	0.83	0.74	0.63	0.47	0.32	0.34	0.53	0.74	0.87	0.92	(89)

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

(90)m=	18.04	18.42	18.89	19.42	19.82	20.07	20.14	20.14	20.01	19.54	18.74	17.98	(90)

fLA = Living area ÷ (4) = 0.48 (91)

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

(92)m=	18.71	19.03	19.44	19.9	20.24	20.47	20.54	20.53	20.42	20	19.3	18.65	(92)

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

(93)m=	18.71	19.03	19.44	19.9	20.24	20.47	20.54	20.53	20.42	20	19.3	18.65	(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=	0.9	0.86	0.81	0.74	0.63	0.49	0.35	0.37	0.54	0.74	0.86	0.91	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	372.51	408.04	415.06	390.85	336.32	248.72	174.52	181.73	261.64	332.74	352.63	357.96	(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=	685.59	670.41	611.91	512.02	396.63	268.14	179.94	188.28	290.47	436.12	569.92	679.31	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	232.93	176.31	146.46	87.25	44.87	0	0	0	0	76.91	156.45	239.09	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1160.26 (98)

Space heating requirement in kWh/m²/year 23.08 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)

Space heating **kWh/year**

Annual space heating requirement 1160.26

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1392.31	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1823.47	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2188.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	35.8	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		95.83	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	95.83	(331)
Energy for lighting (calculated in Appendix L)		235.03	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3181.26	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	893.4	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.58	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	911.98	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				911.98	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	49.73	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	121.98	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				704.79	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.02	(384)
EI rating (section 14)					90.09	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.49

Property Address: Block V - Mid Floor

Address : V, Block V, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.27	(1a) x	2.5	(2a) =	125.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.27	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		125.68	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 2			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Windows Type 3			6	x1/[1/(1.2)+ 0.04]		=	6.87			(27)
Walls Type1	30.1	9.87	20.23	x	0.16	=	3.24			(29)
Walls Type2	35.78	1.91	33.87	x	0.15	=	5.09			(29)
Total area of elements, m²			65.88							(31)
Party wall			10.85	x	0	=	0			(32)
Party floor			50.27							(32a)
Party ceiling			50.27							(32b)

** 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) =	21.54	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	4494.01	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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		5.69	(36)

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

Total fabric heat loss	(33) + (36) =	27.23	(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

DER WorkSheet: New dwelling design stage

(38)m=	12.28	12.13	11.99	11.26	11.11	10.39	10.39	10.24	10.68	11.11	11.41	11.7	(38)

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

(39)m=	39.5	39.36	39.21	38.49	38.34	37.62	37.62	37.47	37.91	38.34	38.63	38.92	

Average = Sum(39)$_{1...12}$ /12= 38.45 (39)

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

(40)m=	0.79	0.78	0.78	0.77	0.76	0.75	0.75	0.75	0.75	0.76	0.77	0.77	

Average = Sum(40)$_{1...12}$ /12= 0.76 (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 1.7 (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 74.53 (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=	81.98	79	76.02	73.04	70.06	67.08	67.08	70.06	73.04	76.02	79	81.98	

Total = Sum(44)$_{1...12}$ = 894.34 (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=	121.58	106.33	109.72	95.66	91.79	79.21	73.4	84.22	85.23	99.33	108.42	117.74	

Total = Sum(45)$_{1...12}$ = 1172.63 (45)

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

(46)m=	18.24	15.95	16.46	14.35	13.77	11.88	11.01	12.63	12.78	14.9	16.26	17.66	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	176.85	156.26	165	149.15	147.07	132.7	128.67	139.5	138.72	154.6	161.92	173.02	(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=	176.85	156.26	165	149.15	147.07	132.7	128.67	139.5	138.72	154.6	161.92	173.02

Output from water heater (annual)$_{1...12}$ | 1823.47 | (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=	84.65	75.3	80.7	74.6	74.74	69.13	68.63	72.23	71.13	77.25	78.85	83.37	(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=	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.31	11.82	9.61	7.28	5.44	4.59	4.96	6.45	8.66	10.99	12.83	13.68	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	147.94	149.47	145.6	137.37	126.97	117.2	110.67	109.14	113.01	121.24	131.64	141.41	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	(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=	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	(71)
Water heating gains (Table 5)													
(72)m=	113.77	112.05	108.47	103.61	100.46	96.02	92.24	97.08	98.8	103.83	109.51	112.06	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	323.49	321.81	312.16	296.73	281.34	266.28	256.35	261.14	268.93	284.53	302.45	315.61	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	1.44	x	36.79	x	0.45	x	0.7	=	11.57	(77)

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Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	1.44	x	62.67	x	0.45	x	0.7	=	19.7	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	1.44	x	85.75	x	0.45	x	0.7	=	26.96	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	1.44	x	106.25	x	0.45	x	0.7	=	33.4	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	1.44	x	119.01	x	0.45	x	0.7	=	37.41	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	1.44	x	118.15	x	0.45	x	0.7	=	37.14	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	1.44	x	113.91	x	0.45	x	0.7	=	35.81	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	1.44	x	104.39	x	0.45	x	0.7	=	32.81	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	1.44	x	92.85	x	0.45	x	0.7	=	29.19	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	1.44	x	69.27	x	0.45	x	0.7	=	21.77	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	1.44	x	44.07	x	0.45	x	0.7	=	13.85	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	1.44	x	31.49	x	0.45	x	0.7	=	9.9	(77)
South	0.9x	0.77	x	6	x	46.75	x	0.45	x	0.7	=	61.23	(78)
South	0.9x	0.77	x	6	x	76.57	x	0.45	x	0.7	=	100.29	(78)
South	0.9x	0.77	x	6	x	97.53	x	0.45	x	0.7	=	127.75	(78)
South	0.9x	0.77	x	6	x	110.23	x	0.45	x	0.7	=	144.38	(78)
South	0.9x	0.77	x	6	x	114.87	x	0.45	x	0.7	=	150.45	(78)
South	0.9x	0.77	x	6	x	110.55	x	0.45	x	0.7	=	144.79	(78)
South	0.9x	0.77	x	6	x	108.01	x	0.45	x	0.7	=	141.47	(78)
South	0.9x	0.77	x	6	x	104.89	x	0.45	x	0.7	=	137.39	(78)
South	0.9x	0.77	x	6	x	101.89	x	0.45	x	0.7	=	133.45	(78)
South	0.9x	0.77	x	6	x	82.59	x	0.45	x	0.7	=	108.17	(78)
South	0.9x	0.77	x	6	x	55.42	x	0.45	x	0.7	=	72.58	(78)
South	0.9x	0.77	x	6	x	40.4	x	0.45	x	0.7	=	52.91	(78)

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

(83)m=	92.32	153.23	200.19	234.14	251	244.61	237.7	225.58	211.89	166.69	109.81	79.51	(83)

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

(84)m=	415.8	475.04	512.35	530.87	532.34	510.88	494.05	486.71	480.82	451.22	412.26	395.13	(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

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(86)m=	0.91	0.87	0.81	0.72	0.6	0.45	0.33	0.35	0.51	0.72	0.86	0.92	(86)

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

(87)m=	19.85	20.1	20.37	20.66	20.85	20.96	20.99	20.99	20.94	20.7	20.26	19.81	(87)

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

(88)m=	20.27	20.27	20.27	20.28	20.29	20.3	20.3	20.3	20.29	20.29	20.28	20.28	(88)

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

(89)m=	0.9	0.85	0.79	0.69	0.57	0.41	0.28	0.3	0.47	0.69	0.85	0.91	(89)

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

(90)m=	18.74	19.08	19.47	19.87	20.12	20.26	20.29	20.29	20.23	19.93	19.32	18.68	(90)

fLA = Living area ÷ (4) = 0.48 (91)

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

(92)m=	19.27	19.57	19.9	20.25	20.47	20.6	20.63	20.63	20.57	20.31	19.77	19.23	(92)

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

(93)m=	19.27	19.57	19.9	20.25	20.47	20.6	20.63	20.63	20.57	20.31	19.77	19.23	(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=	0.88	0.84	0.78	0.69	0.58	0.43	0.3	0.32	0.48	0.69	0.83	0.9	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	367.59	398.87	400.2	367.98	306.83	218.04	149.75	156.22	232.89	313.43	344.07	353.86	(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=	591.54	577.37	525.58	436.75	336.37	225.6	151.49	158.37	245.24	372.12	489.54	584.9	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	166.62	119.95	93.28	49.51	21.98	0	0	0	0	43.67	104.74	171.9	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 771.65 (98)

Space heating requirement in kWh/m²/year 15.35 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)

Space heating	**kWh/year**
Annual space heating requirement	771.65

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	925.98	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1823.47	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2188.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	31.14	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		95.83	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	95.83	(331)
Energy for lighting (calculated in Appendix L)		235.03	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		2714.93	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	777.04	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	16.16	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	793.2	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				793.2	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	49.73	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	121.98	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =		-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				586.01	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				11.66	(384)
EI rating (section 14)					91.76	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block V - Top Floor

Address : V, Block V, Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	52.71	(1a)	x	2.5	(2a)	=	131.77	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.71	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			131.77	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

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

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

0.18	0.18	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.3	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	
Doors			1.91	x	1	=	1.91			(26)
Windows Type 1			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Windows Type 2			5.88	x1/[1/(1.2)+ 0.04]		=	6.73			(27)
Windows Type 3			2.43	x1/[1/(1.2)+ 0.04]		=	2.78			(27)
Walls Type1	24.5	10.74	13.76	x	0.16	=	2.2			(29)
Walls Type2	27.38	1.91	25.47	x	0.15	=	3.83			(29)
Roof	52.71	0	52.71	x	0.1	=	5.27			(30)
Total area of elements, m²			104.58							(31)
Party wall			24.8	x	0	=	0			(32)
Party floor			52.71							(32a)

** 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) =	25.51	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	4051.81	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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		15.54	(36)

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

Total fabric heat loss	(33) + (36) =	41.05	(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

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	12.87	12.72	12.57	11.81	11.65	10.89	10.89	10.74	11.2	11.65	11.96	12.26		(38)

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

(39)m=	53.93	53.77	53.62	52.86	52.71	51.95	51.95	51.8	52.25	52.71	53.01	53.32		
											Average = Sum(39)$_{1...12}$ /12=		52.82	(39)

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

(40)m=	1.02	1.02	1.02	1	1	0.99	0.99	0.98	0.99	1	1.01	1.01		
											Average = Sum(40)$_{1...12}$ /12=		1	(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 1.77 (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 76.24 (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=	83.86	80.81	77.76	74.71	71.66	68.61	68.61	71.66	74.71	77.76	80.81	83.86		
										Total = Sum(44)$_{1...12}$ =			914.85	(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=	124.36	108.77	112.24	97.85	93.89	81.02	75.08	86.15	87.18	101.6	110.91	120.44		
										Total = Sum(45)$_{1...12}$ =			1199.52	(45)

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

(46)m=	18.65	16.32	16.84	14.68	14.08	12.15	11.26	12.92	13.08	15.24	16.64	18.07	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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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=	179.64	158.7	167.52	151.35	149.17	134.52	130.36	141.43	140.68	156.88	164.4	175.72	(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=	179.64	158.7	167.52	151.35	149.17	134.52	130.36	141.43	140.68	156.88	164.4	175.72

Output from water heater (annual)$_{1...12}$ | 1850.36 | (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=	85.57	76.11	81.54	75.33	75.44	69.74	69.19	72.87	71.78	78	79.67	84.27	(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=	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	(66)

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

(67)m=	13.82	12.28	9.99	7.56	5.65	4.77	5.16	6.7	8.99	11.42	13.33	14.21	(67)

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

(68)m=	154.27	155.87	151.83	143.25	132.4	122.22	115.41	113.81	117.84	126.43	137.27	147.46	(68)

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

(69)m=	31.85	31.85	31.85	31.85	31.85	31.85	31.85	31.85	31.85	31.85	31.85	31.85	(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=	-70.8	-70.8	-70.8	-70.8	-70.8	-70.8	-70.8	-70.8	-70.8	-70.8	-70.8	-70.8	(71)

Water heating gains (Table 5)

(72)m=	115.02	113.26	109.6	104.63	101.4	96.85	92.99	97.94	99.7	104.85	110.66	113.26	(72)

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

(73)m=	332.66	330.95	320.97	304.98	289.01	273.39	263.11	268	276.09	292.25	310.81	324.48	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	5.88	x	36.79	x	0.45	x	0.7	=	47.23	(77)

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Southeast	0.9x	0.77	x	2.43	x	36.79	x	0.45	x	0.7	=	19.52	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	5.88	x	62.67	x	0.45	x	0.7	=	80.45	(77)
Southeast	0.9x	0.77	x	2.43	x	62.67	x	0.45	x	0.7	=	33.25	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	5.88	x	85.75	x	0.45	x	0.7	=	110.07	(77)
Southeast	0.9x	0.77	x	2.43	x	85.75	x	0.45	x	0.7	=	45.49	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	5.88	x	106.25	x	0.45	x	0.7	=	136.38	(77)
Southeast	0.9x	0.77	x	2.43	x	106.25	x	0.45	x	0.7	=	56.36	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	5.88	x	119.01	x	0.45	x	0.7	=	152.76	(77)
Southeast	0.9x	0.77	x	2.43	x	119.01	x	0.45	x	0.7	=	63.13	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	5.88	x	118.15	x	0.45	x	0.7	=	151.65	(77)
Southeast	0.9x	0.77	x	2.43	x	118.15	x	0.45	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	5.88	x	113.91	x	0.45	x	0.7	=	146.21	(77)
Southeast	0.9x	0.77	x	2.43	x	113.91	x	0.45	x	0.7	=	60.42	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	5.88	x	104.39	x	0.45	x	0.7	=	133.99	(77)
Southeast	0.9x	0.77	x	2.43	x	104.39	x	0.45	x	0.7	=	55.37	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	5.88	x	92.85	x	0.45	x	0.7	=	119.18	(77)
Southeast	0.9x	0.77	x	2.43	x	92.85	x	0.45	x	0.7	=	49.25	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	5.88	x	69.27	x	0.45	x	0.7	=	88.91	(77)
Southeast	0.9x	0.77	x	2.43	x	69.27	x	0.45	x	0.7	=	36.74	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	5.88	x	44.07	x	0.45	x	0.7	=	56.57	(77)
Southeast	0.9x	0.77	x	2.43	x	44.07	x	0.45	x	0.7	=	23.38	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)
Southeast	0.9x	0.77	x	5.88	x	31.49	x	0.45	x	0.7	=	40.42	(77)
Southeast	0.9x	0.77	x	2.43	x	31.49	x	0.45	x	0.7	=	16.7	(77)

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

(83)m=	86.26	146.94	201.05	249.11	279.02	277	267.06	244.74	217.69	162.4	103.32	73.82	(83)

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

(84)m=	418.92	477.89	522.01	554.09	568.02	550.39	530.16	512.74	493.78	454.64	414.13	398.3	(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

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(86)m=	0.93	0.91	0.86	0.79	0.68	0.54	0.41	0.44	0.62	0.81	0.9	0.94	(86)

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

(87)m=	19.19	19.46	19.84	20.28	20.64	20.87	20.96	20.95	20.8	20.35	19.71	19.15	(87)

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

(88)m=	20.06	20.07	20.07	20.08	20.08	20.1	20.1	20.1	20.09	20.08	20.08	20.07	(88)

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

(89)m=	0.93	0.89	0.85	0.76	0.64	0.48	0.33	0.36	0.56	0.77	0.89	0.93	(89)

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

(90)m=	17.66	18.05	18.58	19.2	19.68	19.98	20.07	20.06	19.89	19.31	18.41	17.6	(90)

fLA = Living area ÷ (4) = 0.58 (91)

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

(92)m=	18.54	18.86	19.3	19.82	20.23	20.49	20.58	20.57	20.41	19.91	19.16	18.49	(92)

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

(93)m=	18.54	18.86	19.3	19.82	20.23	20.49	20.58	20.57	20.41	19.91	19.16	18.49	(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=	0.91	0.88	0.83	0.76	0.65	0.51	0.37	0.4	0.58	0.77	0.87	0.92	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	380.44	418.62	433	418.36	368.52	278.08	198.07	205.29	286.32	349.09	361.75	365.23	(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=	768.11	750.83	686.58	577.34	449.55	306.02	206.67	215.99	329.93	490.57	639.12	761.84	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	288.43	223.24	188.66	114.47	60.28	0	0	0	0	105.26	199.71	295.07	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1475.13 (98)

Space heating requirement in kWh/m²/year 27.99 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.2	(306)

Space heating **kWh/year**

Annual space heating requirement 1475.13

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1770.15	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1850.36	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2220.43	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	39.91	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		100.48	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	100.48	(331)
Energy for lighting (calculated in Appendix L)		244.15	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-730.07	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3605.13	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				208	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	995.73	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.71	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1016.44	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1016.44	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	52.15	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	126.71	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =		-378.91	(380)
Total CO2, kg/year	sum of (376)…(382) =				816.39	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.49	(384)
EI rating (section 14)					88.8	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.5.49

Property Address: Block P - Mid - HT1

Address : Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	54.97	(1a)	x	2.6	(2a)	=	142.92	(3a)
First floor	57.52	(1b)	x	2.9	(2b)	=	166.81	(3b)
Second floor	39.48	(1c)	x	3.3	(2c)	=	130.28	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	151.97	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	440.01	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(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

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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

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

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.33	0.33	0.33	0.3	0.3	0.28	0.28	0.27	0.29	0.3	0.31	0.32	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.33	0.33	0.33	0.3	0.3	0.28	0.28	0.27	0.29	0.3	0.31	0.32	(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	
Doors			1.97	x	1	=	1.97			(26)
Windows Type 1			10.47	x1/[1/(1.2)+ 0.04]		=	11.99			(27)
Windows Type 2			19.24	x1/[1/(1.2)+ 0.04]		=	22.03			(27)
Floor Type 1			54.97	x	0.1	=	5.497	75	4122.75	(28)
Floor Type 2			2.55	x	0.1	=	0.255	20	51	(28)
Walls	105.02	31.68	73.34	x	0.16	=	11.73	60	4400.4	(29)
Roof Type1	39.48	0	39.48	x	0.1	=	3.95	9	355.32	(30)
Roof Type2	18.04	0	18.04	x	0.1	=	1.8	9	162.36	(30)
Total area of elements, m²			220.06							(31)
Party wall			150.7	x	0	=	0	110	16577	(32)
Internal wall **			306.6					9	2759.4	(32c)
Internal floor			97					18	1746	(32d)
Internal ceiling			97					9	873	(32e)

** 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) = 59.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 31047.23 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 204.3 (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		20.68	(36)
if details of thermal bridging are not known (36) = 0.05 x (31)			
Total fabric heat loss	(33) + (36) =	79.9	(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=	48.53	47.92	47.3	44.21	43.6	40.51	40.51	39.89	41.75	43.6	44.83	46.07	(38)

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

(39)m=	128.44	127.82	127.2	124.12	123.5	120.42	120.42	119.8	121.65	123.5	124.74	125.97	

Average = Sum(39)$_{1...12}$ /12= 123.96 (39)

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

(40)m=	0.85	0.84	0.84	0.82	0.81	0.79	0.79	0.79	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.82 (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 2.94 (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) + 36 103.96 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	114.35	110.2	106.04	101.88	97.72	93.56	93.56	97.72	101.88	106.04	110.2	114.35	

Total = Sum(44)$_{1...12}$ = 1247.51 (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=	169.58	148.32	153.05	133.44	128.03	110.48	102.38	117.48	118.89	138.55	151.24	164.23	

Total = Sum(45)$_{1...12}$ = 1635.68 (45)

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

(46)m=	25.44	22.25	22.96	20.02	19.21	16.57	15.36	17.62	17.83	20.78	22.69	24.64	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		210	(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):		1.53	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.83	(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)			0.83	(55)

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

(56)m=	25.61	23.13	25.61	24.79	25.61	24.79	25.61	25.61	24.79	25.61	24.79	25.61	(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=	25.61	23.13	25.61	24.79	25.61	24.79	25.61	25.61	24.79	25.61	24.79	25.61	(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=	218.46	192.46	201.93	180.73	176.91	157.78	151.25	166.36	166.18	187.42	198.54	213.11	(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=	218.46	192.46	201.93	180.73	176.91	157.78	151.25	166.36	166.18	187.42	198.54	213.11	

Output from water heater (annual)$_{1...12}$ — 2211.14 (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=	95.49	84.63	89.99	82.21	81.67	74.57	73.14	78.16	77.37	85.17	88.12	93.71	(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=	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	(66)

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

(67)m=	29.04	25.79	20.98	15.88	11.87	10.02	10.83	14.08	18.89	23.99	28	29.85	(67)

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

(68)m=	322.66	326.01	317.57	299.61	276.93	255.62	241.39	238.04	246.47	264.44	287.11	308.42	(68)

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

(69)m=	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	(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=	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	(71)

Water heating gains (Table 5)

(72)m=	128.34	125.94	120.95	114.17	109.77	103.58	98.31	105.06	107.46	114.47	122.4	125.95	(72)

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

(73)m=	547.1	544.8	526.56	496.72	465.64	436.28	417.58	424.23	439.88	469.96	504.56	531.28	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	19.24	x	36.79	x	0.45	x	0.7	=	154.53	(77)
Southeast	0.9x	0.77	x	19.24	x	62.67	x	0.45	x	0.7	=	263.23	(77)
Southeast	0.9x	0.77	x	19.24	x	85.75	x	0.45	x	0.7	=	360.16	(77)
Southeast	0.9x	0.77	x	19.24	x	106.25	x	0.45	x	0.7	=	446.26	(77)
Southeast	0.9x	0.77	x	19.24	x	119.01	x	0.45	x	0.7	=	499.84	(77)
Southeast	0.9x	0.77	x	19.24	x	118.15	x	0.45	x	0.7	=	496.23	(77)
Southeast	0.9x	0.77	x	19.24	x	113.91	x	0.45	x	0.7	=	478.42	(77)
Southeast	0.9x	0.77	x	19.24	x	104.39	x	0.45	x	0.7	=	438.44	(77)
Southeast	0.9x	0.77	x	19.24	x	92.85	x	0.45	x	0.7	=	389.98	(77)
Southeast	0.9x	0.77	x	19.24	x	69.27	x	0.45	x	0.7	=	290.92	(77)
Southeast	0.9x	0.77	x	19.24	x	44.07	x	0.45	x	0.7	=	185.1	(77)
Southeast	0.9x	0.77	x	19.24	x	31.49	x	0.45	x	0.7	=	132.25	(77)
Northwest	0.9x	0.77	x	10.47	x	11.28	x	0.45	x	0.7	=	25.79	(81)
Northwest	0.9x	0.77	x	10.47	x	22.97	x	0.45	x	0.7	=	52.49	(81)
Northwest	0.9x	0.77	x	10.47	x	41.38	x	0.45	x	0.7	=	94.57	(81)
Northwest	0.9x	0.77	x	10.47	x	67.96	x	0.45	x	0.7	=	155.32	(81)
Northwest	0.9x	0.77	x	10.47	x	91.35	x	0.45	x	0.7	=	208.78	(81)
Northwest	0.9x	0.77	x	10.47	x	97.38	x	0.45	x	0.7	=	222.58	(81)
Northwest	0.9x	0.77	x	10.47	x	91.1	x	0.45	x	0.7	=	208.22	(81)
Northwest	0.9x	0.77	x	10.47	x	72.63	x	0.45	x	0.7	=	165.99	(81)
Northwest	0.9x	0.77	x	10.47	x	50.42	x	0.45	x	0.7	=	115.24	(81)
Northwest	0.9x	0.77	x	10.47	x	28.07	x	0.45	x	0.7	=	64.15	(81)
Northwest	0.9x	0.77	x	10.47	x	14.2	x	0.45	x	0.7	=	32.45	(81)
Northwest	0.9x	0.77	x	10.47	x	9.21	x	0.45	x	0.7	=	21.06	(81)

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

(83)m=	180.32	315.72	454.73	601.57	708.62	718.81	686.63	604.43	505.22	355.07	217.54	153.31	(83)

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

(84)m=	727.42	860.52	981.29	1098.29	1174.25	1155.08	1104.22	1028.66	945.1	825.03	722.11	684.59	(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	0.64	0.48	0.53	0.8	0.97	1	1	(86)

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

(87)m=	20.13	20.25	20.44	20.68	20.86	20.94	20.95	20.95	20.9	20.67	20.35	20.12	(87)

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

(88)m=	20.21	20.22	20.22	20.24	20.24	20.26	20.26	20.26	20.25	20.24	20.24	20.23	(88)

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

(89)m=	1	0.99	0.98	0.93	0.8	0.58	0.4	0.45	0.74	0.96	0.99	1	(89)

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

(90)m=	19.02	19.21	19.48	19.84	20.07	20.18	20.19	20.19	20.14	19.83	19.38	19.02	(90)

fLA = Living area ÷ (4) = 0.26 (91)

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

(92)m=	19.31	19.48	19.73	20.06	20.27	20.37	20.38	20.39	20.33	20.04	19.63	19.3	(92)

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

(93)m=	19.31	19.48	19.73	20.06	20.27	20.37	20.38	20.39	20.33	20.04	19.63	19.3	(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	0.8	0.59	0.41	0.46	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	725.24	853.85	959.82	1019.82	942.44	679.99	454.13	474.57	703.39	787.18	716.97	683.1	(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=	1927.44	1863.19	1682.86	1384.65	1058.99	695.23	455.75	477.58	758.39	1166.44	1562.79	1902.3	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	894.44	678.28	537.95	262.68	86.71	0	0	0	0	282.16	608.99	907.09	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4258.3 (98)

Space heating requirement in kWh/m²/year 28.02 (99)

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		333.14	(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)													
	894.44	678.28	537.95	262.68	86.71	0	0	0	0	282.16	608.99	907.09	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	268.48	203.6	161.48	78.85	26.03	0	0	0	0	84.7	182.8	272.28	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1278.21 (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)

218.46	192.46	201.93	180.73	176.91	157.78	151.25	166.36	166.18	187.42	198.54	213.11

Efficiency of water heater 282.62 (216)

(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	77.3	68.1	71.45	63.95	62.59	55.83	53.52	58.86	58.8	66.32	70.25	75.4

Total = $Sum(219a)_{1...12}$ = 782.36 (219)

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			1278.21	
Water heating fuel used			782.36	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		389.19		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		389.19	(231)
Electricity for lighting			512.88	(232)
Electricity generated by PVs			-730.07	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			2232.57	(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	0.519	=	663.39	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	406.04	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1069.44	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	201.99	(267)
Electricity for lighting	(232)	x	0.519	=	266.18	(268)
Energy saving/generation technologies						
Item 1			0.519	=	-378.91	(269)
Total CO2, kg/year			sum of (265)…(271) =		1158.7	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		7.62	(273)
EI rating (section 14)					92	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.5.49

Property Address: Block Q - End - HT1

Address : Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	54.97	(1a)	x	2.6	(2a)	=	142.92	(3a)
First floor	57.52	(1b)	x	2.9	(2b)	=	166.81	(3b)
Second floor	39.48	(1c)	x	3.3	(2c)	=	130.28	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	151.97	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	440.01	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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 *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*		0	(11)
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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(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

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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

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

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.33	0.33	0.33	0.3	0.3	0.28	0.28	0.27	0.29	0.3	0.31	0.32	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.33	0.33	0.33	0.3	0.3	0.28	0.28	0.27	0.29	0.3	0.31	0.32	(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	
Doors			1.97	x	1	=	1.97			(26)
Windows Type 1			10.47	x1/[1/(1.2)+ 0.04]		=	11.99			(27)
Windows Type 2			19.24	x1/[1/(1.2)+ 0.04]		=	22.03			(27)
Floor Type 1			54.97	x	0.1	=	5.497	75	4122.75	(28)
Floor Type 2			2.55	x	0.1	=	0.255	20	51	(28)
Walls	179.27	31.68	147.59	x	0.16	=	23.61	60	8855.4	(29)
Roof Type1	39.48	0	39.48	x	0.1	=	3.95	9	355.32	(30)
Roof Type2	18.04	0	18.04	x	0.1	=	1.8	9	162.36	(30)
Total area of elements, m²			294.31							(31)
Party wall			76.49	x	0	=	0	110	8413.899	(32)
Internal wall **			306.6					9	2759.4	(32c)
Internal floor			97					18	1746	(32d)
Internal ceiling			97					9	873	(32e)

** 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) =	71.11	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	27339.13	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	= (34) ÷ (4) =	179.9	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 22.84 (36)

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

Total fabric heat loss (33) + (36) = 93.95 (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=	48.53	47.92	47.3	44.21	43.6	40.51	40.51	39.89	41.75	43.6	44.83	46.07	(38)

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

(39)m=	142.48	141.87	141.25	138.17	137.55	134.46	134.46	133.85	135.7	137.55	138.78	140.02	

Average = $Sum(39)_{1...12}$ /12= 138.01 (39)

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

(40)m=	0.94	0.93	0.93	0.91	0.91	0.88	0.88	0.88	0.89	0.91	0.91	0.92	

Average = $Sum(40)_{1...12}$ /12= 0.91 (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 — 2.94 (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 — 103.96 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	114.35	110.2	106.04	101.88	97.72	93.56	93.56	97.72	101.88	106.04	110.2	114.35

Total = $Sum(44)_{1...12}$ = 1247.51 (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=	169.58	148.32	153.05	133.44	128.03	110.48	102.38	117.48	118.89	138.55	151.24	164.23

Total = $Sum(45)_{1...12}$ = 1635.68 (45)

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

(46)m=	25.44	22.25	22.96	20.02	19.21	16.57	15.36	17.62	17.83	20.78	22.69	24.64	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 180 (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): — 1.6 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.86 (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)		0.86	(55)

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

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	219.63	193.52	203.1	181.87	178.08	158.92	152.43	167.53	167.32	188.6	199.67	214.28	(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=	219.63	193.52	203.1	181.87	178.08	158.92	152.43	167.53	167.32	188.6	199.67	214.28	

Output from water heater (annual)$_{1...12}$ | 2224.94 | (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=	96.42	85.48	90.93	83.11	82.61	75.48	74.08	79.1	78.27	86.1	89.03	94.64	(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=	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	(66)

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

(67)m=	29.04	25.79	20.98	15.88	11.87	10.02	10.83	14.08	18.89	23.99	28	29.85	(67)

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

(68)m=	322.66	326.01	317.57	299.61	276.93	255.62	241.39	238.04	246.47	264.44	287.11	308.42	(68)

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

(69)m=	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	(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=	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	(71)

Water heating gains (Table 5)

(72)m=	129.6	127.2	122.21	115.43	111.03	104.84	99.57	106.32	108.72	115.73	123.66	127.21	(72)

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

(73)m=	548.36	546.06	527.82	497.98	466.9	437.54	418.84	425.49	441.14	471.22	505.82	532.54	(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)	
Southeast	0.9x	0.77	x	19.24	x	36.79	x	0.45	x	0.7	=	154.53	(77)
Southeast	0.9x	0.77	x	19.24	x	62.67	x	0.45	x	0.7	=	263.23	(77)
Southeast	0.9x	0.77	x	19.24	x	85.75	x	0.45	x	0.7	=	360.16	(77)
Southeast	0.9x	0.77	x	19.24	x	106.25	x	0.45	x	0.7	=	446.26	(77)
Southeast	0.9x	0.77	x	19.24	x	119.01	x	0.45	x	0.7	=	499.84	(77)
Southeast	0.9x	0.77	x	19.24	x	118.15	x	0.45	x	0.7	=	496.23	(77)
Southeast	0.9x	0.77	x	19.24	x	113.91	x	0.45	x	0.7	=	478.42	(77)
Southeast	0.9x	0.77	x	19.24	x	104.39	x	0.45	x	0.7	=	438.44	(77)
Southeast	0.9x	0.77	x	19.24	x	92.85	x	0.45	x	0.7	=	389.98	(77)
Southeast	0.9x	0.77	x	19.24	x	69.27	x	0.45	x	0.7	=	290.92	(77)
Southeast	0.9x	0.77	x	19.24	x	44.07	x	0.45	x	0.7	=	185.1	(77)
Southeast	0.9x	0.77	x	19.24	x	31.49	x	0.45	x	0.7	=	132.25	(77)
Northwest	0.9x	0.77	x	10.47	x	11.28	x	0.45	x	0.7	=	25.79	(81)
Northwest	0.9x	0.77	x	10.47	x	22.97	x	0.45	x	0.7	=	52.49	(81)
Northwest	0.9x	0.77	x	10.47	x	41.38	x	0.45	x	0.7	=	94.57	(81)
Northwest	0.9x	0.77	x	10.47	x	67.96	x	0.45	x	0.7	=	155.32	(81)
Northwest	0.9x	0.77	x	10.47	x	91.35	x	0.45	x	0.7	=	208.78	(81)
Northwest	0.9x	0.77	x	10.47	x	97.38	x	0.45	x	0.7	=	222.58	(81)
Northwest	0.9x	0.77	x	10.47	x	91.1	x	0.45	x	0.7	=	208.22	(81)
Northwest	0.9x	0.77	x	10.47	x	72.63	x	0.45	x	0.7	=	165.99	(81)
Northwest	0.9x	0.77	x	10.47	x	50.42	x	0.45	x	0.7	=	115.24	(81)
Northwest	0.9x	0.77	x	10.47	x	28.07	x	0.45	x	0.7	=	64.15	(81)
Northwest	0.9x	0.77	x	10.47	x	14.2	x	0.45	x	0.7	=	32.45	(81)
Northwest	0.9x	0.77	x	10.47	x	9.21	x	0.45	x	0.7	=	21.06	(81)

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

(83)m=	180.32	315.72	454.73	601.57	708.62	718.81	686.63	604.43	505.22	355.07	217.54	153.31	(83)

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

(84)m=	728.68	861.78	982.55	1099.55	1175.51	1156.34	1105.48	1029.92	946.36	826.29	723.37	685.85	(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	0.95	0.86	0.69	0.52	0.58	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=	19.91	20.04	20.26	20.54	20.77	20.9	20.93	20.93	20.84	20.54	20.17	19.89	(87)

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

(88)m=	20.14	20.14	20.14	20.16	20.16	20.18	20.18	20.18	20.17	20.16	20.16	20.15	(88)

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

(89)m=	1	0.99	0.98	0.93	0.82	0.62	0.43	0.48	0.76	0.95	0.99	1	(89)

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

(90)m=	18.64	18.85	19.17	19.58	19.89	20.06	20.09	20.09	20	19.59	19.06	18.64	(90)

fLA = Living area ÷ (4) = 0.26 (91)

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

(92)m=	18.97	19.16	19.45	19.83	20.12	20.28	20.31	20.31	20.21	19.84	19.34	18.96	(92)

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

(93)m=	18.97	19.16	19.45	19.83	20.12	20.28	20.31	20.31	20.21	19.84	19.34	18.96	(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	0.93	0.82	0.63	0.45	0.5	0.77	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	724.75	851.66	955.35	1017.96	961.2	724	492.36	512.67	725.88	784.03	715.46	683.02	(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=	2089.89	2022.54	1828.83	1510.01	1157.87	763.48	498.58	522.94	829.4	1270.28	1699.34	2066.38	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1015.66	786.83	649.86	354.28	146.33	0	0	0	0	361.77	708.39	1029.22	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5052.34 (98)

Space heating requirement in kWh/m²/year 33.25 (99)

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		378.01	(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)													
	1015.66	786.83	649.86	354.28	146.33	0	0	0	0	361.77	708.39	1029.22	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	268.68	208.15	171.92	93.72	38.71	0	0	0	0	95.7	187.4	272.27	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1336.55 (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)

219.63	193.52	203.1	181.87	178.08	158.92	152.43	167.53	167.32	188.6	199.67	214.28

Efficiency of water heater 282.62 (216)

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(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	77.71	68.47	71.86	64.35	63.01	56.23	53.93	59.28	59.2	66.73	70.65	75.82

Total = Sum(219a)$_{1...12}$ = 787.24 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1336.55	
Water heating fuel used			787.24	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		389.19		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		389.19	(231)
Electricity for lighting			512.88	(232)
Electricity generated by PVs			-730.07	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			2295.79	(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	0.519	=	693.67	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	408.58	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1102.25	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	201.99	(267)
Electricity for lighting	(232)	x	0.519	=	266.18	(268)
Energy saving/generation technologies						
Item 1			0.519	=	-378.91	(269)
Total CO2, kg/year			sum of (265)…(271) =		1191.51	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		7.84	(273)
EI rating (section 14)					92	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block Q - Mid - HT1

Address :	Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	54.97	(1a)	x	2.6	(2a)	=	142.92	(3a)
First floor	57.52	(1b)	x	2.9	(2b)	=	166.81	(3b)
Second floor	39.48	(1c)	x	3.3	(2c)	=	130.28	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	151.97	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	440.01	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(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

DER WorkSheet: New dwelling design stage

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

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

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.33	0.33	0.33	0.3	0.3	0.28	0.28	0.27	0.29	0.3	0.31	0.32	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.33	0.33	0.33	0.3	0.3	0.28	0.28	0.27	0.29	0.3	0.31	0.32	(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	
Doors			1.97	x	1	=	1.97			(26)
Windows Type 1			10.47	x1/[1/(1.2)+ 0.04]		=	11.99			(27)
Windows Type 2			19.24	x1/[1/(1.2)+ 0.04]		=	22.03			(27)
Floor Type 1			54.97	x	0.1	=	5.497	75	4122.75	(28)
Floor Type 2			2.55	x	0.1	=	0.255	20	51	(28)
Walls	105.02	31.68	73.34	x	0.16	=	11.73	60	4400.4	(29)
Roof Type1	39.48	0	39.48	x	0.1	=	3.95	9	355.32	(30)
Roof Type2	18.04	0	18.04	x	0.1	=	1.8	9	162.36	(30)
Total area of elements, m²			220.06							(31)
Party wall			150.7	x	0	=	0	110	16577	(32)
Internal wall **			306.6					9	2759.4	(32c)
Internal floor			97					18	1746	(32d)
Internal ceiling			97					9	873	(32e)

** 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) = 59.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 31047.23 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 204.3 (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 — 20.68 (36)

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

Total fabric heat loss — (33) + (36) = 79.9 (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=	48.53	47.92	47.3	44.21	43.6	40.51	40.51	39.89	41.75	43.6	44.83	46.07	(38)

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

(39)m=	128.44	127.82	127.2	124.12	123.5	120.42	120.42	119.8	121.65	123.5	124.74	125.97	

Average = Sum(39)$_{1…12}$ /12= 123.96 (39)

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

(40)m=	0.85	0.84	0.84	0.82	0.81	0.79	0.79	0.79	0.8	0.81	0.82	0.83

Average = Sum(40)$_{1…12}$ /12= 0.82 (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 — 2.94 (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 — 103.96 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	114.35	110.2	106.04	101.88	97.72	93.56	93.56	97.72	101.88	106.04	110.2	114.35

Total = Sum(44)$_{1…12}$ = 1247.51 (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=	169.58	148.32	153.05	133.44	128.03	110.48	102.38	117.48	118.89	138.55	151.24	164.23

Total = Sum(45)$_{1…12}$ = 1635.68 (45)

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

(46)m=	25.44	22.25	22.96	20.02	19.21	16.57	15.36	17.62	17.83	20.78	22.69	24.64	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 180 (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): — 1.6 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.86 (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)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.86	(55)

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

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	219.63	193.52	203.1	181.87	178.08	158.92	152.43	167.53	167.32	188.6	199.67	214.28	(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=	219.63	193.52	203.1	181.87	178.08	158.92	152.43	167.53	167.32	188.6	199.67	214.28	

Output from water heater (annual)$_{1\ldots12}$ | 2224.94 | (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=	96.42	85.48	90.93	83.11	82.61	75.48	74.08	79.1	78.27	86.1	89.03	94.64	(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=	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	146.86	(66)

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

(67)m=	29.04	25.79	20.98	15.88	11.87	10.02	10.83	14.08	18.89	23.99	28	29.85	(67)

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

(68)m=	322.66	326.01	317.57	299.61	276.93	255.62	241.39	238.04	246.47	264.44	287.11	308.42	(68)

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

(69)m=	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	37.69	(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=	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	-117.49	(71)

Water heating gains (Table 5)

(72)m=	129.6	127.2	122.21	115.43	111.03	104.84	99.57	106.32	108.72	115.73	123.66	127.21	(72)

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

(73)m=	548.36	546.06	527.82	497.98	466.9	437.54	418.84	425.49	441.14	471.22	505.82	532.54	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	19.24	x	36.79	x	0.45	x	0.7	=	154.53	(77)
Southeast	0.9x	0.77	x	19.24	x	62.67	x	0.45	x	0.7	=	263.23	(77)
Southeast	0.9x	0.77	x	19.24	x	85.75	x	0.45	x	0.7	=	360.16	(77)
Southeast	0.9x	0.77	x	19.24	x	106.25	x	0.45	x	0.7	=	446.26	(77)
Southeast	0.9x	0.77	x	19.24	x	119.01	x	0.45	x	0.7	=	499.84	(77)
Southeast	0.9x	0.77	x	19.24	x	118.15	x	0.45	x	0.7	=	496.23	(77)
Southeast	0.9x	0.77	x	19.24	x	113.91	x	0.45	x	0.7	=	478.42	(77)
Southeast	0.9x	0.77	x	19.24	x	104.39	x	0.45	x	0.7	=	438.44	(77)
Southeast	0.9x	0.77	x	19.24	x	92.85	x	0.45	x	0.7	=	389.98	(77)
Southeast	0.9x	0.77	x	19.24	x	69.27	x	0.45	x	0.7	=	290.92	(77)
Southeast	0.9x	0.77	x	19.24	x	44.07	x	0.45	x	0.7	=	185.1	(77)
Southeast	0.9x	0.77	x	19.24	x	31.49	x	0.45	x	0.7	=	132.25	(77)
Northwest	0.9x	0.77	x	10.47	x	11.28	x	0.45	x	0.7	=	25.79	(81)
Northwest	0.9x	0.77	x	10.47	x	22.97	x	0.45	x	0.7	=	52.49	(81)
Northwest	0.9x	0.77	x	10.47	x	41.38	x	0.45	x	0.7	=	94.57	(81)
Northwest	0.9x	0.77	x	10.47	x	67.96	x	0.45	x	0.7	=	155.32	(81)
Northwest	0.9x	0.77	x	10.47	x	91.35	x	0.45	x	0.7	=	208.78	(81)
Northwest	0.9x	0.77	x	10.47	x	97.38	x	0.45	x	0.7	=	222.58	(81)
Northwest	0.9x	0.77	x	10.47	x	91.1	x	0.45	x	0.7	=	208.22	(81)
Northwest	0.9x	0.77	x	10.47	x	72.63	x	0.45	x	0.7	=	165.99	(81)
Northwest	0.9x	0.77	x	10.47	x	50.42	x	0.45	x	0.7	=	115.24	(81)
Northwest	0.9x	0.77	x	10.47	x	28.07	x	0.45	x	0.7	=	64.15	(81)
Northwest	0.9x	0.77	x	10.47	x	14.2	x	0.45	x	0.7	=	32.45	(81)
Northwest	0.9x	0.77	x	10.47	x	9.21	x	0.45	x	0.7	=	21.06	(81)

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

(83)m=	180.32	315.72	454.73	601.57	708.62	718.81	686.63	604.43	505.22	355.07	217.54	153.31	(83)

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

(84)m=	728.68	861.78	982.55	1099.55	1175.51	1156.34	1105.48	1029.92	946.36	826.29	723.37	685.85	(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	0.64	0.48	0.53	0.8	0.97	1	1	(86)

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

(87)m=	20.13	20.25	20.44	20.68	20.86	20.94	20.95	20.95	20.9	20.67	20.35	20.12	(87)

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

(88)m=	20.21	20.22	20.22	20.24	20.24	20.26	20.26	20.26	20.25	20.24	20.24	20.23	(88)

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

(89)m=	1	0.99	0.98	0.93	0.8	0.58	0.4	0.45	0.74	0.96	0.99	1	(89)

DER WorkSheet: New dwelling design stage

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

(90)m=	19.02	19.21	19.49	19.84	20.07	20.18	20.19	20.19	20.14	19.83	19.38	19.02	(90)

fLA = Living area ÷ (4) = 0.26 (91)

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

(92)m=	19.31	19.48	19.73	20.06	20.28	20.37	20.38	20.39	20.33	20.05	19.63	19.3	(92)

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

(93)m=	19.31	19.48	19.73	20.06	20.28	20.37	20.38	20.39	20.33	20.05	19.63	19.3	(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	0.8	0.59	0.41	0.46	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	726.48	855.06	960.94	1020.68	942.86	680.07	454.14	474.59	703.68	788.17	718.17	684.34	(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=	1927.56	1863.31	1682.98	1384.74	1059.03	695.24	455.75	477.58	758.42	1166.53	1562.91	1902.42	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	893.61	677.55	537.2	262.12	86.43	0	0	0	0	281.5	608.21	906.25	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 4252.87 (98)

Space heating requirement in kWh/m²/year 27.98 (99)

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		333.14	(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)													
	893.61	677.55	537.2	262.12	86.43	0	0	0	0	281.5	608.21	906.25	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	268.24	203.38	161.25	78.68	25.94	0	0	0	0	84.5	182.57	272.03	

Total (kWh/year) =$Sum(211)_{1...5,10...12}$= 1276.58 (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)

219.63	193.52	203.1	181.87	178.08	158.92	152.43	167.53	167.32	188.6	199.67	214.28

Efficiency of water heater 282.62 (216)

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(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	77.71	68.47	71.86	64.35	63.01	56.23	53.93	59.28	59.2	66.73	70.65	75.82	

	Total = Sum(219a)$_{1...12}$ =		787.24	(219)
Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1276.58	
Water heating fuel used			787.24	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		389.19		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		389.19	(231)
Electricity for lighting			512.88	(232)
Electricity generated by PVs			-730.07	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			2235.82	(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	0.519	=	662.55	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	408.58	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1071.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	201.99	(267)
Electricity for lighting	(232) x	0.519	=	266.18	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-378.91	(269)
Total CO2, kg/year		sum of (265)…(271) =		1160.39	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		7.64	(273)
EI rating (section 14)				92	(274)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block G - Mid - HT 2

Address : Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	56.35	(1a)	x	2.6	(2a)	=	146.51	(3a)
First floor	57.24	(1b)	x	2.9	(2b)	=	166	(3b)
Second floor	51.36	(1c)	x	3.3	(2c)	=	169.49	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	164.95	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			481.99	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(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

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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

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	
Doors			1.97	x	1	=	1.97			(26)
Windows Type 1			11.1		x1/[1/(1.2)+ 0.04]	=	12.71			(27)
Windows Type 2			19.24		x1/[1/(1.2)+ 0.04]	=	22.03			(27)
Windows Type 3			2.86		x1/[1/(1.2)+ 0.04]	=	3.27			(27)
Floor Type 1			55.08	x	0.1	=	5.508	75	4131	(28)
Floor Type 2			2.16	x	0.1	=	0.216	20	43.2	(28)
Walls	111.26	35.17	76.09	x	0.16	=	12.17	60	4565.4	(29)
Roof Type1	51.36	0	51.36	x	0.1	=	5.14	9	462.24	(30)
Roof Type2	5.88	0	5.88	x	0.1	=	0.59	9	52.92	(30)
Roof Type3	1.27	0	1.27	x	0.1	=	0.13	9	11.43	(30)
Total area of elements, m²			227.01							(31)
Party wall			164.44	x	0	=	0	110	18088.4	(32)
Internal wall **			315.9					9	2843.1	(32c)
Internal floor			108.6					18	1954.8	(32d)
Internal ceiling			108.6					9	977.4	(32e)

** 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) = 63.73 (33)

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Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 33129.89 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 200.85 (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 19.81 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 83.54 (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=	53.84	53.17	52.49	49.11	48.43	45.05	45.05	44.38	46.41	48.43	49.79	51.14	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	137.38	136.71	136.03	132.65	131.98	128.6	128.6	127.92	129.95	131.98	133.33	134.68	

Average = Sum(39)$_{1…12}$ /12= 132.48 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.78	0.78	0.78	0.79	0.8	0.81	0.82	

Average = Sum(40)$_{1…12}$ /12= 0.8 (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 2.96 (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) + 36 104.4 (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=	114.84	110.66	106.49	102.31	98.14	93.96	93.96	98.14	102.31	106.49	110.66	114.84	

Total = Sum(44)$_{1…12}$ = 1252.79 (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=	170.3	148.95	153.7	134	128.58	110.95	102.81	117.98	119.39	139.14	151.88	164.93	

Total = Sum(45)$_{1…12}$ = 1642.6 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.55	22.34	23.06	20.1	19.29	16.64	15.42	17.7	17.91	20.87	22.78	24.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 180 (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): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.86 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

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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)	0.86	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	220.35	194.15	203.75	182.43	178.62	159.38	152.86	168.03	167.82	189.18	200.31	214.98	(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=	220.35	194.15	203.75	182.43	178.62	159.38	152.86	168.03	167.82	189.18	200.31	214.98	

Output from water heater (annual)$_{1...12}$ — 2231.86 (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=	96.66	85.69	91.14	83.3	82.79	75.64	74.22	79.27	78.44	86.3	89.24	94.88	(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=	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	30.18	26.8	21.8	16.5	12.34	10.41	11.25	14.63	19.63	24.93	29.1	31.02	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	336.36	339.85	331.06	312.33	288.7	266.48	251.64	248.15	256.94	275.67	299.31	321.52	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	(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=	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	(71)
Water heating gains (Table 5)													
(72)m=	129.92	127.51	122.5	115.7	111.28	105.05	99.76	106.54	108.95	115.99	123.95	127.52	(72)

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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	563.8	561.51	542.7	511.87	479.64	449.28	429.99	436.65	452.86	483.93	519.69	547.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	11.1	x	36.79	x	0.45	x	0.7	=	89.15	(77)
Southeast	0.9x	0.77	x	11.1	x	62.67	x	0.45	x	0.7	=	151.86	(77)
Southeast	0.9x	0.77	x	11.1	x	85.75	x	0.45	x	0.7	=	207.78	(77)
Southeast	0.9x	0.77	x	11.1	x	106.25	x	0.45	x	0.7	=	257.46	(77)
Southeast	0.9x	0.77	x	11.1	x	119.01	x	0.45	x	0.7	=	288.37	(77)
Southeast	0.9x	0.77	x	11.1	x	118.15	x	0.45	x	0.7	=	286.29	(77)
Southeast	0.9x	0.77	x	11.1	x	113.91	x	0.45	x	0.7	=	276.01	(77)
Southeast	0.9x	0.77	x	11.1	x	104.39	x	0.45	x	0.7	=	252.95	(77)
Southeast	0.9x	0.77	x	11.1	x	92.85	x	0.45	x	0.7	=	224.99	(77)
Southeast	0.9x	0.77	x	11.1	x	69.27	x	0.45	x	0.7	=	167.84	(77)
Southeast	0.9x	0.77	x	11.1	x	44.07	x	0.45	x	0.7	=	106.79	(77)
Southeast	0.9x	0.77	x	11.1	x	31.49	x	0.45	x	0.7	=	76.3	(77)
South	0.9x	0.77	x	2.86	x	46.75	x	0.45	x	0.7	=	29.19	(78)
South	0.9x	0.77	x	2.86	x	76.57	x	0.45	x	0.7	=	47.8	(78)
South	0.9x	0.77	x	2.86	x	97.53	x	0.45	x	0.7	=	60.89	(78)
South	0.9x	0.77	x	2.86	x	110.23	x	0.45	x	0.7	=	68.82	(78)
South	0.9x	0.77	x	2.86	x	114.87	x	0.45	x	0.7	=	71.72	(78)
South	0.9x	0.77	x	2.86	x	110.55	x	0.45	x	0.7	=	69.02	(78)
South	0.9x	0.77	x	2.86	x	108.01	x	0.45	x	0.7	=	67.43	(78)
South	0.9x	0.77	x	2.86	x	104.89	x	0.45	x	0.7	=	65.49	(78)
South	0.9x	0.77	x	2.86	x	101.89	x	0.45	x	0.7	=	63.61	(78)
South	0.9x	0.77	x	2.86	x	82.59	x	0.45	x	0.7	=	51.56	(78)
South	0.9x	0.77	x	2.86	x	55.42	x	0.45	x	0.7	=	34.6	(78)
South	0.9x	0.77	x	2.86	x	40.4	x	0.45	x	0.7	=	25.22	(78)
Northwest	0.9x	0.77	x	19.24	x	11.28	x	0.45	x	0.7	=	47.39	(81)
Northwest	0.9x	0.77	x	19.24	x	22.97	x	0.45	x	0.7	=	96.46	(81)
Northwest	0.9x	0.77	x	19.24	x	41.38	x	0.45	x	0.7	=	173.79	(81)
Northwest	0.9x	0.77	x	19.24	x	67.96	x	0.45	x	0.7	=	285.41	(81)
Northwest	0.9x	0.77	x	19.24	x	91.35	x	0.45	x	0.7	=	383.65	(81)
Northwest	0.9x	0.77	x	19.24	x	97.38	x	0.45	x	0.7	=	409.01	(81)
Northwest	0.9x	0.77	x	19.24	x	91.1	x	0.45	x	0.7	=	382.62	(81)
Northwest	0.9x	0.77	x	19.24	x	72.63	x	0.45	x	0.7	=	305.03	(81)
Northwest	0.9x	0.77	x	19.24	x	50.42	x	0.45	x	0.7	=	211.77	(81)
Northwest	0.9x	0.77	x	19.24	x	28.07	x	0.45	x	0.7	=	117.88	(81)

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Northwest 0.9x	0.77	x	19.24	x	14.2	x	0.45	x	0.7	=	59.63	(81)
Northwest 0.9x	0.77	x	19.24	x	9.21	x	0.45	x	0.7	=	38.7	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	165.73	296.13	442.47	611.69	743.74	764.32	726.07	623.47	500.36	337.28	201.01	140.22	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	729.53	857.63	985.16	1123.56	1223.38	1213.6	1156.06	1060.12	953.23	821.21	720.7	687.62	(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	0.85	0.65	0.49	0.55	0.82	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.1	20.22	20.41	20.66	20.85	20.94	20.95	20.95	20.89	20.64	20.33	20.09	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.23	20.23	20.25	20.25	20.27	20.27	20.27	20.26	20.25	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.94	0.81	0.59	0.41	0.46	0.77	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.99	19.17	19.45	19.82	20.08	20.19	20.2	20.2	20.14	19.8	19.35	18.99	(90)

fLA = Living area ÷ (4) = | 0.25 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.27	19.43	19.69	20.03	20.27	20.37	20.39	20.39	20.33	20.01	19.59	19.27	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.27	19.43	19.69	20.03	20.27	20.37	20.39	20.39	20.33	20.01	19.59	19.27	(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	0.94	0.81	0.6	0.42	0.48	0.77	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	727.9	852.76	968.47	1054.46	996.12	725.07	485.07	506.36	737.35	792.46	716.94	686.5	(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=	2056.35	1986.25	1793.59	1476.37	1130.79	742.64	487	510.2	809.05	1241.7	1665.36	2029.07	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	988.37	761.71	613.88	303.78	100.2	0	0	0	0	334.23	682.87	998.87	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = | 4783.91 | (98)

Space heating requirement in kWh/m²/year | 29 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

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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		360.15	(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)	988.37	761.71	613.88	303.78	100.2	0	0	0	0	334.23	682.87	998.87		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	274.43	211.5	170.45	84.35	27.82	0	0	0	0	92.8	189.61	277.35		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													1328.3	(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	kWh/year	
Output from water heater (calculated above)	220.35	194.15	203.75	182.43	178.62	159.38	152.86	168.03	167.82	189.18	200.31	214.98		
Efficiency of water heater													282.62	(216)
(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	77.97	68.7	72.09	64.55	63.2	56.39	54.09	59.45	59.38	66.94	70.87	76.06		
Total = Sum(219a)$_{1...12}$ =													789.69	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1328.3	
Water heating fuel used			789.69	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		521.88		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		521.88	(231)
Electricity for lighting			532.96	(232)
Electricity generated by PVs			-730.07	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			2442.76	(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	0.519	=	689.39	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	409.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1099.24	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	270.86	(267)

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Electricity for lighting	(232) x	0.519	=	276.61	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-378.91	(269)
Total CO2, kg/year	sum of (265)…(271) =			1267.79	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			7.69	(273)
EI rating (section 14)				92	(274)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block K - Mid - HT 3

Address : Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	56.35	(1a)	x	2.6	(2a)	=	146.51	(3a)
First floor	57.24	(1b)	x	2.9	(2b)	=	166	(3b)
Second floor	51.36	(1c)	x	3.3	(2c)	=	169.49	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	164.95	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	481.99	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(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

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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

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	
Doors			1.97	x	1	=	1.97			(26)
Windows Type 1			11.1	x1/[1/(1.2)+ 0.04]		=	12.71			(27)
Windows Type 2			19.24	x1/[1/(1.2)+ 0.04]		=	22.03			(27)
Windows Type 3			2.86	x1/[1/(1.2)+ 0.04]		=	3.27			(27)
Floor Type 1			55.08	x	0.1	=	5.508	75	4131	(28)
Floor Type 2			2.16	x	0.1	=	0.216	20	43.2	(28)
Walls	111.26	35.17	76.09	x	0.16	=	12.17	60	4565.4	(29)
Roof Type1	51.36	0	51.36	x	0.1	=	5.14	9	462.24	(30)
Roof Type2	5.88	0	5.88	x	0.1	=	0.59	9	52.92	(30)
Roof Type3	1.27	0	1.27	x	0.1	=	0.13	9	11.43	(30)
Total area of elements, m²			227.01							(31)
Party wall			164.44	x	0	=	0	110	18088.4	(32)
Internal wall **			315.9					9	2843.1	(32c)
Internal floor			108.6					18	1954.8	(32d)
Internal ceiling			108.6					9	977.4	(32e)

** 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) = 63.73 (33)

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Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	33129.89	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	= (34) ÷ (4) =	200.85	(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		19.81	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	83.54	(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=	53.84	53.17	52.49	49.11	48.43	45.05	45.05	44.38	46.41	48.43	49.79	51.14	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	137.38	136.71	136.03	132.65	131.98	128.6	128.6	127.92	129.95	131.98	133.33	134.68	

Average = Sum(39)$_{1…12}$ /12= 132.48 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.78	0.78	0.78	0.79	0.8	0.81	0.82	

Average = Sum(40)$_{1…12}$ /12= 0.8 (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 2.96 (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) + 36 104.4 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	114.84	110.66	106.49	102.31	98.14	93.96	93.96	98.14	102.31	106.49	110.66	114.84

Total = Sum(44)$_{1…12}$ = 1252.79 (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=	170.3	148.95	153.7	134	128.58	110.95	102.81	117.98	119.39	139.14	151.88	164.93

Total = Sum(45)$_{1…12}$ = 1642.6 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.55	22.34	23.06	20.1	19.29	16.64	15.42	17.7	17.91	20.87	22.78	24.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 180 (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): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.86 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

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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)		0.86	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	220.35	194.15	203.75	182.43	178.62	159.38	152.86	168.03	167.82	189.18	200.31	214.98	(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=	220.35	194.15	203.75	182.43	178.62	159.38	152.86	168.03	167.82	189.18	200.31	214.98	

Output from water heater (annual)1…12 — 2231.86 (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=	96.66	85.69	91.14	83.3	82.79	75.64	74.22	79.27	78.44	86.3	89.24	94.88	(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=	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	30.18	26.8	21.8	16.5	12.34	10.41	11.25	14.63	19.63	24.93	29.1	31.02	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	336.36	339.85	331.06	312.33	288.7	266.48	251.64	248.15	256.94	275.67	299.31	321.52	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	(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=	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	(71)

Water heating gains (Table 5)

(72)m=	129.92	127.51	122.5	115.7	111.28	105.05	99.76	106.54	108.95	115.99	123.95	127.52	(72)

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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	563.8	561.51	542.7	511.87	479.64	449.28	429.99	436.65	452.86	483.93	519.69	547.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	11.1	x	36.79	x	0.45	x	0.7	=	89.15	(77)
Southeast	0.9x	0.77	x	11.1	x	62.67	x	0.45	x	0.7	=	151.86	(77)
Southeast	0.9x	0.77	x	11.1	x	85.75	x	0.45	x	0.7	=	207.78	(77)
Southeast	0.9x	0.77	x	11.1	x	106.25	x	0.45	x	0.7	=	257.46	(77)
Southeast	0.9x	0.77	x	11.1	x	119.01	x	0.45	x	0.7	=	288.37	(77)
Southeast	0.9x	0.77	x	11.1	x	118.15	x	0.45	x	0.7	=	286.29	(77)
Southeast	0.9x	0.77	x	11.1	x	113.91	x	0.45	x	0.7	=	276.01	(77)
Southeast	0.9x	0.77	x	11.1	x	104.39	x	0.45	x	0.7	=	252.95	(77)
Southeast	0.9x	0.77	x	11.1	x	92.85	x	0.45	x	0.7	=	224.99	(77)
Southeast	0.9x	0.77	x	11.1	x	69.27	x	0.45	x	0.7	=	167.84	(77)
Southeast	0.9x	0.77	x	11.1	x	44.07	x	0.45	x	0.7	=	106.79	(77)
Southeast	0.9x	0.77	x	11.1	x	31.49	x	0.45	x	0.7	=	76.3	(77)
South	0.9x	0.77	x	2.86	x	46.75	x	0.45	x	0.7	=	29.19	(78)
South	0.9x	0.77	x	2.86	x	76.57	x	0.45	x	0.7	=	47.8	(78)
South	0.9x	0.77	x	2.86	x	97.53	x	0.45	x	0.7	=	60.89	(78)
South	0.9x	0.77	x	2.86	x	110.23	x	0.45	x	0.7	=	68.82	(78)
South	0.9x	0.77	x	2.86	x	114.87	x	0.45	x	0.7	=	71.72	(78)
South	0.9x	0.77	x	2.86	x	110.55	x	0.45	x	0.7	=	69.02	(78)
South	0.9x	0.77	x	2.86	x	108.01	x	0.45	x	0.7	=	67.43	(78)
South	0.9x	0.77	x	2.86	x	104.89	x	0.45	x	0.7	=	65.49	(78)
South	0.9x	0.77	x	2.86	x	101.89	x	0.45	x	0.7	=	63.61	(78)
South	0.9x	0.77	x	2.86	x	82.59	x	0.45	x	0.7	=	51.56	(78)
South	0.9x	0.77	x	2.86	x	55.42	x	0.45	x	0.7	=	34.6	(78)
South	0.9x	0.77	x	2.86	x	40.4	x	0.45	x	0.7	=	25.22	(78)
Northwest	0.9x	0.77	x	19.24	x	11.28	x	0.45	x	0.7	=	47.39	(81)
Northwest	0.9x	0.77	x	19.24	x	22.97	x	0.45	x	0.7	=	96.46	(81)
Northwest	0.9x	0.77	x	19.24	x	41.38	x	0.45	x	0.7	=	173.79	(81)
Northwest	0.9x	0.77	x	19.24	x	67.96	x	0.45	x	0.7	=	285.41	(81)
Northwest	0.9x	0.77	x	19.24	x	91.35	x	0.45	x	0.7	=	383.65	(81)
Northwest	0.9x	0.77	x	19.24	x	97.38	x	0.45	x	0.7	=	409.01	(81)
Northwest	0.9x	0.77	x	19.24	x	91.1	x	0.45	x	0.7	=	382.62	(81)
Northwest	0.9x	0.77	x	19.24	x	72.63	x	0.45	x	0.7	=	305.03	(81)
Northwest	0.9x	0.77	x	19.24	x	50.42	x	0.45	x	0.7	=	211.77	(81)
Northwest	0.9x	0.77	x	19.24	x	28.07	x	0.45	x	0.7	=	117.88	(81)

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Northwest	0.9x	0.77	x	19.24	x	14.2	x	0.45	x	0.7	=	59.63	(81)
Northwest	0.9x	0.77	x	19.24	x	9.21	x	0.45	x	0.7	=	38.7	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	165.73	296.13	442.47	611.69	743.74	764.32	726.07	623.47	500.36	337.28	201.01	140.22	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	729.53	857.63	985.16	1123.56	1223.38	1213.6	1156.06	1060.12	953.23	821.21	720.7	687.62	(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	0.85	0.65	0.49	0.55	0.82	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.1	20.22	20.41	20.66	20.85	20.94	20.95	20.95	20.89	20.64	20.33	20.09	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.23	20.23	20.25	20.25	20.27	20.27	20.27	20.26	20.25	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.94	0.81	0.59	0.41	0.46	0.77	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.99	19.17	19.45	19.82	20.08	20.19	20.2	20.2	20.14	19.8	19.35	18.99	(90)

fLA = Living area ÷ (4) = 0.25 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.27	19.43	19.69	20.03	20.27	20.37	20.39	20.39	20.33	20.01	19.59	19.27	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.27	19.43	19.69	20.03	20.27	20.37	20.39	20.39	20.33	20.01	19.59	19.27	(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	0.94	0.81	0.6	0.42	0.48	0.77	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	727.9	852.76	968.47	1054.46	996.12	725.07	485.07	506.36	737.35	792.46	716.94	686.5	(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=	2056.35	1986.25	1793.59	1476.37	1130.79	742.64	487	510.2	809.05	1241.7	1665.36	2029.07	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	988.37	761.71	613.88	303.78	100.2	0	0	0	0	334.23	682.87	998.87	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4783.91 (98)

Space heating requirement in kWh/m²/year 29 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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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		360.15	(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)														
	988.37	761.71	613.88	303.78	100.2	0	0	0	0	334.23	682.87	998.87		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	274.43	211.5	170.45	84.35	27.82	0	0	0	0	92.8	189.61	277.35		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1328.3	(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	kWh/year	
Output from water heater (calculated above)	220.35	194.15	203.75	182.43	178.62	159.38	152.86	168.03	167.82	189.18	200.31	214.98		
Efficiency of water heater													282.62	(216)
(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	77.97	68.7	72.09	64.55	63.2	56.39	54.09	59.45	59.38	66.94	70.87	76.06		
Total = Sum(219a)$_{1...12}$ =													789.69	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1328.3	
Water heating fuel used			789.69	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		521.88		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		521.88	(231)
Electricity for lighting			532.96	(232)
Electricity generated by PVs			-730.07	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			2442.76	(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	0.519	=	689.39	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	409.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1099.24	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	270.86	(267)

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Electricity for lighting	(232) x	0.519	=	276.61	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-378.91	(269)
Total CO2, kg/year	sum of (265)…(271) =			1267.79	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			7.69	(273)
EI rating (section 14)				92	(274)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block K - End - HT 2

Address : Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	56.35	(1a) x	2.6	(2a) =	146.51	(3a)
First floor	57.24	(1b) x	2.9	(2b) =	166	(3b)
Second floor	51.36	(1c) x	3.3	(2c) =	169.49	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	164.95	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		481.99	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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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

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	
Doors			1.97	x	1	=	1.97			(26)
Windows Type 1			11.1	x1/[1/(1.2)+ 0.04]		=	12.71			(27)
Windows Type 2			19.24	x1/[1/(1.2)+ 0.04]		=	22.03			(27)
Windows Type 3			2.86	x1/[1/(1.2)+ 0.04]		=	3.27			(27)
Floor Type 1			55.08	x	0.1	=	5.508	75	4131	(28)
Floor Type 2			2.16	x	0.1	=	0.216	20	43.2	(28)
Walls	188.93	35.17	153.76	x	0.16	=	24.6	60	9225.6	(29)
Roof Type1	51.36	0	51.36	x	0.1	=	5.14	9	462.24	(30)
Roof Type2	5.88	0	5.88	x	0.1	=	0.59	9	52.92	(30)
Roof Type3	1.27	0	1.27	x	0.1	=	0.13	9	11.43	(30)
Total area of elements, m²			304.68							(31)
Party wall			86.77	x	0	=	0	110	9544.699	(32)
Internal wall **			315.9					9	2843.1	(32c)
Internal floor			108.6					18	1954.8	(32d)
Internal ceiling			108.6					9	977.4	(32e)

** 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) = 76.16 (33)

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Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	29246.39	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	= (34) ÷ (4) =	177.3	(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		20.7	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	96.86	(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=	53.84	53.17	52.49	49.11	48.43	45.05	45.05	44.38	46.41	48.43	49.79	51.14	(38)

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

(39)m=	150.7	150.03	149.35	145.97	145.29	141.91	141.91	141.24	143.27	145.29	146.65	148	

Average = Sum(39)1…12 /12= 145.8 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	0.91	0.91	0.91	0.88	0.88	0.86	0.86	0.86	0.87	0.88	0.89	0.9	

Average = Sum(40)1…12 /12= 0.88 (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 — 2.96 (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 — 104.4 (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	114.84	110.66	106.49	102.31	98.14	93.96	93.96	98.14	102.31	106.49	110.66	114.84

Total = Sum(44)1…12 = 1252.79 (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=	170.3	148.95	153.7	134	128.58	110.95	102.81	117.98	119.39	139.14	151.88	164.93

Total = Sum(45)1…12 = 1642.6 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.55	22.34	23.06	20.1	19.29	16.64	15.42	17.7	17.91	20.87	22.78	24.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 180 (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): — 1.6 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.86 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

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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)		0.86	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	220.35	194.15	203.75	182.43	178.62	159.38	152.86	168.03	167.82	189.18	200.31	214.98	(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=	220.35	194.15	203.75	182.43	178.62	159.38	152.86	168.03	167.82	189.18	200.31	214.98	

Output from water heater (annual)$_{1…12}$ | 2231.86 | (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=	96.66	85.69	91.14	83.3	82.79	75.64	74.22	79.27	78.44	86.3	89.24	94.88	(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=	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	147.79	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	30.18	26.8	21.8	16.5	12.34	10.41	11.25	14.63	19.63	24.93	29.1	31.02	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	336.36	339.85	331.06	312.33	288.7	266.48	251.64	248.15	256.94	275.67	299.31	321.52	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	(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=	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	-118.23	(71)

Water heating gains (Table 5)

(72)m=	129.92	127.51	122.5	115.7	111.28	105.05	99.76	106.54	108.95	115.99	123.95	127.52	(72)

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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	563.8	561.51	542.7	511.87	479.64	449.28	429.99	436.65	452.86	483.93	519.69	547.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	11.1	x	36.79	x	0.45	x	0.7	=	89.15	(77)
Southeast	0.9x	0.77	x	11.1	x	62.67	x	0.45	x	0.7	=	151.86	(77)
Southeast	0.9x	0.77	x	11.1	x	85.75	x	0.45	x	0.7	=	207.78	(77)
Southeast	0.9x	0.77	x	11.1	x	106.25	x	0.45	x	0.7	=	257.46	(77)
Southeast	0.9x	0.77	x	11.1	x	119.01	x	0.45	x	0.7	=	288.37	(77)
Southeast	0.9x	0.77	x	11.1	x	118.15	x	0.45	x	0.7	=	286.29	(77)
Southeast	0.9x	0.77	x	11.1	x	113.91	x	0.45	x	0.7	=	276.01	(77)
Southeast	0.9x	0.77	x	11.1	x	104.39	x	0.45	x	0.7	=	252.95	(77)
Southeast	0.9x	0.77	x	11.1	x	92.85	x	0.45	x	0.7	=	224.99	(77)
Southeast	0.9x	0.77	x	11.1	x	69.27	x	0.45	x	0.7	=	167.84	(77)
Southeast	0.9x	0.77	x	11.1	x	44.07	x	0.45	x	0.7	=	106.79	(77)
Southeast	0.9x	0.77	x	11.1	x	31.49	x	0.45	x	0.7	=	76.3	(77)
South	0.9x	0.77	x	2.86	x	46.75	x	0.45	x	0.7	=	29.19	(78)
South	0.9x	0.77	x	2.86	x	76.57	x	0.45	x	0.7	=	47.8	(78)
South	0.9x	0.77	x	2.86	x	97.53	x	0.45	x	0.7	=	60.89	(78)
South	0.9x	0.77	x	2.86	x	110.23	x	0.45	x	0.7	=	68.82	(78)
South	0.9x	0.77	x	2.86	x	114.87	x	0.45	x	0.7	=	71.72	(78)
South	0.9x	0.77	x	2.86	x	110.55	x	0.45	x	0.7	=	69.02	(78)
South	0.9x	0.77	x	2.86	x	108.01	x	0.45	x	0.7	=	67.43	(78)
South	0.9x	0.77	x	2.86	x	104.89	x	0.45	x	0.7	=	65.49	(78)
South	0.9x	0.77	x	2.86	x	101.89	x	0.45	x	0.7	=	63.61	(78)
South	0.9x	0.77	x	2.86	x	82.59	x	0.45	x	0.7	=	51.56	(78)
South	0.9x	0.77	x	2.86	x	55.42	x	0.45	x	0.7	=	34.6	(78)
South	0.9x	0.77	x	2.86	x	40.4	x	0.45	x	0.7	=	25.22	(78)
Northwest	0.9x	0.77	x	19.24	x	11.28	x	0.45	x	0.7	=	47.39	(81)
Northwest	0.9x	0.77	x	19.24	x	22.97	x	0.45	x	0.7	=	96.46	(81)
Northwest	0.9x	0.77	x	19.24	x	41.38	x	0.45	x	0.7	=	173.79	(81)
Northwest	0.9x	0.77	x	19.24	x	67.96	x	0.45	x	0.7	=	285.41	(81)
Northwest	0.9x	0.77	x	19.24	x	91.35	x	0.45	x	0.7	=	383.65	(81)
Northwest	0.9x	0.77	x	19.24	x	97.38	x	0.45	x	0.7	=	409.01	(81)
Northwest	0.9x	0.77	x	19.24	x	91.1	x	0.45	x	0.7	=	382.62	(81)
Northwest	0.9x	0.77	x	19.24	x	72.63	x	0.45	x	0.7	=	305.03	(81)
Northwest	0.9x	0.77	x	19.24	x	50.42	x	0.45	x	0.7	=	211.77	(81)
Northwest	0.9x	0.77	x	19.24	x	28.07	x	0.45	x	0.7	=	117.88	(81)

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Northwest 0.9x	0.77	x	19.24	x	14.2	x	0.45	x	0.7	=	59.63	(81)
Northwest 0.9x	0.77	x	19.24	x	9.21	x	0.45	x	0.7	=	38.7	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	165.73	296.13	442.47	611.69	743.74	764.32	726.07	623.47	500.36	337.28	201.01	140.22	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	729.53	857.63	985.16	1123.56	1223.38	1213.6	1156.06	1060.12	953.23	821.21	720.7	687.62	(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	0.99	0.95	0.86	0.69	0.53	0.59	0.84	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.89	20.02	20.24	20.53	20.77	20.9	20.93	20.93	20.83	20.52	20.15	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.16	20.18	20.18	20.2	20.2	20.2	20.19	20.18	20.18	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.83	0.62	0.44	0.5	0.79	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.64	18.84	19.15	19.59	19.91	20.08	20.11	20.11	20.01	19.58	19.05	18.64	(90)

fLA = Living area ÷ (4) = | 0.25 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.95	19.13	19.42	19.82	20.12	20.29	20.32	20.32	20.21	19.81	19.33	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.95	19.13	19.42	19.82	20.12	20.29	20.32	20.32	20.21	19.81	19.33	18.95	(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	0.83	0.63	0.45	0.51	0.79	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	726.51	849.93	963.18	1049.67	1009.98	765.39	520.99	541.49	753.09	787.66	714.68	685.45	(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=	2207.94	2134.93	1929.95	1593.87	1223.84	807.22	527.62	553.15	875.48	1338.66	1792.87	2182.32	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1102.19	863.52	719.28	391.83	159.11	0	0	0	0	409.94	776.3	1113.67	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 5535.84 | (98)

Space heating requirement in kWh/m²/year | 33.56 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

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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		403.65	(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)	1102.19	863.52	719.28	391.83	159.11	0	0	0	0	409.94	776.3	1113.67		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	273.06	213.93	178.2	97.07	39.42	0	0	0	0	101.56	192.32	275.9		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1371.46	(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	kWh/year	
Output from water heater (calculated above)	220.35	194.15	203.75	182.43	178.62	159.38	152.86	168.03	167.82	189.18	200.31	214.98		
Efficiency of water heater													282.62	(216)
(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	77.97	68.7	72.09	64.55	63.2	56.39	54.09	59.45	59.38	66.94	70.87	76.06		
Total = Sum(219a)$_{1...12}$ =													789.69	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1371.46	
Water heating fuel used			789.69	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		521.88		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		521.88	(231)
Electricity for lighting			532.96	(232)
Electricity generated by PVs			-730.07	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			2485.92	(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	0.519	=	711.79	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	409.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1121.64	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	270.86	(267)

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Electricity for lighting	(232) x	0.519	=	276.61	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-378.91	(269)
Total CO2, kg/year		sum of (265)…(271) =		1290.19	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		7.82	(273)
EI rating (section 14)				92	(274)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.49

Property Address: Block F - Mid - HT 5

Address : Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	50.66	(1a)	x	2.6	(2a)	=	131.72	(3a)
First floor	57.24	(1b)	x	2.9	(2b)	=	166	(3b)
Second floor	57.24	(1c)	x	3.3	(2c)	=	188.89	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	165.14	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	486.6	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(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

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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

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	
Doors			3.08	x	1	=	3.08			(26)
Windows Type 1			12.59	x1/[1/(1.2)+ 0.04]		=	14.42			(27)
Windows Type 2			16.57	x1/[1/(1.2)+ 0.04]		=	18.97			(27)
Floor Type 1			50.66	x	0.1	=	5.066	75	3799.5	(28)
Floor Type 2			6.59	x	0.1	=	0.659	20	131.8	(28)
Walls	107.07	32.24	74.83	x	0.16	=	11.97	60	4489.8	(29)
Roof	57.25	0	57.25	x	0.1	=	5.73	9	515.25	(30)
Total area of elements, m²			221.57							(31)
Party wall			168.72	x	0	=	0	110	18559.2	(32)
Internal wall **			304.9					9	2744.1	(32c)
Internal floor			104.48					18	1880.64	(32d)
Internal ceiling			104.48					104.48	10916.07	(32e)

** 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) = 59.89 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 43036.36 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 260.61 (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 | 19.88 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 79.77 | (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=	54.36	53.67	52.99	49.58	48.9	45.48	45.48	44.8	46.85	48.9	50.26	51.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	134.12	133.44	132.76	129.35	128.66	125.25	125.25	124.57	126.62	128.66	130.03	131.39	

Average = $Sum(39)_{1...12}$ /12= | 129.18 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.81	0.81	0.8	0.78	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8

Average = $Sum(40)_{1...12}$ /12= | 0.78 | (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 | 2.96 | (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 | 104.41 | (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	114.85	110.67	106.49	102.32	98.14	93.96	93.96	98.14	102.32	106.49	110.67	114.85

Total = $Sum(44)_{1...12}$ = | 1252.86 | (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=	170.31	148.96	153.71	134.01	128.58	110.96	102.82	117.99	119.4	139.14	151.89	164.94

Total = $Sum(45)_{1...12}$ = | 1642.7 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.55	22.34	23.06	20.1	19.29	16.64	15.42	17.7	17.91	20.87	22.78	24.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 180 | (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): | 1.6 | (48)

Temperature factor from Table 2b | 0.54 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0.86 | (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)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.86	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	220.36	194.16	203.76	182.44	178.63	159.39	152.87	168.03	167.83	189.19	200.32	214.99	(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=	220.36	194.16	203.76	182.44	178.63	159.39	152.87	168.03	167.83	189.19	200.32	214.99	

Output from water heater (annual)$_{1...12}$ — 2231.96 (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=	96.67	85.69	91.15	83.3	82.79	75.64	74.22	79.27	78.44	86.3	89.25	94.88	(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=	147.8	147.8	147.8	147.8	147.8	147.8	147.8	147.8	147.8	147.8	147.8	147.8	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	30.74	27.3	22.21	16.81	12.57	10.61	11.46	14.9	20	25.39	29.64	31.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	336.56	340.05	331.25	312.52	288.86	266.64	251.79	248.29	257.09	275.83	299.48	321.71	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	(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=	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	(71)

Water heating gains (Table 5)

(72)m=	129.93	127.52	122.51	115.7	111.28	105.05	99.76	106.54	108.95	116	123.96	127.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	564.57	562.21	543.3	512.37	480.05	449.64	430.35	437.08	453.39	484.56	520.42	548.17	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	16.57	x	11.28	x	0.45	x	0.7	=	40.81	(75)
Northeast	0.9x	0.77	x	16.57	x	22.97	x	0.45	x	0.7	=	83.07	(75)
Northeast	0.9x	0.77	x	16.57	x	41.38	x	0.45	x	0.7	=	149.67	(75)
Northeast	0.9x	0.77	x	16.57	x	67.96	x	0.45	x	0.7	=	245.81	(75)
Northeast	0.9x	0.77	x	16.57	x	91.35	x	0.45	x	0.7	=	330.41	(75)
Northeast	0.9x	0.77	x	16.57	x	97.38	x	0.45	x	0.7	=	352.25	(75)
Northeast	0.9x	0.77	x	16.57	x	91.1	x	0.45	x	0.7	=	329.53	(75)
Northeast	0.9x	0.77	x	16.57	x	72.63	x	0.45	x	0.7	=	262.7	(75)
Northeast	0.9x	0.77	x	16.57	x	50.42	x	0.45	x	0.7	=	182.38	(75)
Northeast	0.9x	0.77	x	16.57	x	28.07	x	0.45	x	0.7	=	101.52	(75)
Northeast	0.9x	0.77	x	16.57	x	14.2	x	0.45	x	0.7	=	51.35	(75)
Northeast	0.9x	0.77	x	16.57	x	9.21	x	0.45	x	0.7	=	33.33	(75)
Southwest	0.9x	0.77	x	12.59	x	36.79		0.45	x	0.7	=	101.12	(79)
Southwest	0.9x	0.77	x	12.59	x	62.67		0.45	x	0.7	=	172.25	(79)
Southwest	0.9x	0.77	x	12.59	x	85.75		0.45	x	0.7	=	235.68	(79)
Southwest	0.9x	0.77	x	12.59	x	106.25		0.45	x	0.7	=	292.01	(79)
Southwest	0.9x	0.77	x	12.59	x	119.01		0.45	x	0.7	=	327.08	(79)
Southwest	0.9x	0.77	x	12.59	x	118.15		0.45	x	0.7	=	324.72	(79)
Southwest	0.9x	0.77	x	12.59	x	113.91		0.45	x	0.7	=	313.06	(79)
Southwest	0.9x	0.77	x	12.59	x	104.39		0.45	x	0.7	=	286.9	(79)
Southwest	0.9x	0.77	x	12.59	x	92.85		0.45	x	0.7	=	255.19	(79)
Southwest	0.9x	0.77	x	12.59	x	69.27		0.45	x	0.7	=	190.37	(79)
Southwest	0.9x	0.77	x	12.59	x	44.07		0.45	x	0.7	=	121.12	(79)
Southwest	0.9x	0.77	x	12.59	x	31.49		0.45	x	0.7	=	86.54	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	141.93	255.32	385.35	537.82	657.49	676.97	642.59	549.6	437.57	291.89	172.47	119.87	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	706.5	817.53	928.65	1050.19	1137.54	1126.61	1072.94	986.68	890.95	776.46	692.89	668.04	(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	1	0.98	0.9	0.69	0.51	0.58	0.87	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.29	20.38	20.52	20.72	20.89	20.95	20.96	20.96	20.92	20.71	20.47	20.29	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.25	20.25	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.26	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	0.97	0.86	0.62	0.43	0.49	0.82	0.99	1	1	(89)

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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.26	19.4	19.61	19.92	20.14	20.23	20.23	20.24	20.19	19.91	19.55	19.27	(90)

fLA = Living area ÷ (4) = 0.19 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.46	19.58	19.78	20.07	20.28	20.36	20.37	20.37	20.33	20.06	19.72	19.46	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.46	19.58	19.78	20.07	20.28	20.36	20.37	20.37	20.33	20.06	19.72	19.46	(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	1	0.99	0.97	0.86	0.63	0.44	0.5	0.82	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	706.2	816.46	923.7	1018.66	983.14	711.96	471.62	493.41	730.04	765.07	692.03	667.85	(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=	2032.75	1958.87	1763.38	1444.96	1103.62	722	472.25	494.91	788.4	1216.76	1641.03	2005.07	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	986.95	767.7	624.73	306.93	89.64	0	0	0	0	336.05	683.28	994.89	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4790.18 (98)

Space heating requirement in kWh/m²/year 29.01 (99)

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		349.59	(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)													
	986.95	767.7	624.73	306.93	89.64	0	0	0	0	336.05	683.28	994.89	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	282.31	219.6	178.7	87.8	25.64	0	0	0	0	96.13	195.45	284.58	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1370.21 (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)

220.36	194.16	203.76	182.44	178.63	159.39	152.87	168.03	167.83	189.19	200.32	214.99

Efficiency of water heater 282.62 (216)

DER WorkSheet: New dwelling design stage

(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	77.97	68.7	72.09	64.55	63.2	56.4	54.09	59.45	59.38	66.94	70.88	76.07

Total = Sum(219a)$_{1...12}$ = 789.72 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1370.21	
Water heating fuel used			789.72	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		526.87		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		526.87	(231)
Electricity for lighting			542.91	(232)
Electricity generated by PVs			-730.07	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			2499.64	(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	0.519	=	711.14	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	409.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1121	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	273.45	(267)
Electricity for lighting	(232) x	0.519	=	281.77	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-378.91	(269)
Total CO2, kg/year	sum of (265)…(271) =			1297.31	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			7.86	(273)
EI rating (section 14)				92	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.5.49

Property Address: Block L - End - HT 5

Address : Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	50.66	(1a)	x	2.6	(2a)	=	131.72	(3a)
First floor	57.24	(1b)	x	2.9	(2b)	=	166	(3b)
Second floor	57.24	(1c)	x	3.3	(2c)	=	188.89	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	165.14	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	486.6	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(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

DER WorkSheet: New dwelling design stage

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

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	
Doors			3.08	x	1	=	3.08			(26)
Windows Type 1			12.59	x1/[1/(1.2)+ 0.04]		=	14.42			(27)
Windows Type 2			16.57	x1/[1/(1.2)+ 0.04]		=	18.97			(27)
Floor Type 1			50.66	x	0.1	=	5.066	75	3799.5	(28)
Floor Type 2			6.59	x	0.1	=	0.659	20	131.8	(28)
Walls	86.86	32.24	54.62	x	0.16	=	8.74	60	3277.2	(29)
Roof	57.25	0	57.25	x	0.1	=	5.73	9	515.25	(30)
Total area of elements, m²			201.36							(31)
Party wall			81.86	x	0	=	0	110	9004.6	(32)
Internal wall **			304.9					9	2744.1	(32c)
Internal floor			104.48					18	1880.64	(32d)
Internal ceiling			104.48					104.48	10916.07	(32e)

** 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) = 56.66 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 32269.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 195.4 (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 | 20.7 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 77.36 | (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=	54.36	53.67	52.99	49.58	48.9	45.48	45.48	44.8	46.85	48.9	50.26	51.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	131.72	131.04	130.35	126.94	126.26	122.85	122.85	122.16	124.21	126.26	127.62	128.99	

Average = Sum(39)$_{1…12}$ /12= | 126.77 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78

Average = Sum(40)$_{1…12}$ /12= | 0.77 | (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 | 2.96 | (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 | 104.41 | (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)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	114.85	110.67	106.49	102.32	98.14	93.96	93.96	98.14	102.32	106.49	110.67	114.85

Total = Sum(44)$_{1…12}$ = | 1252.86 | (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=	170.31	148.96	153.71	134.01	128.58	110.96	102.82	117.99	119.4	139.14	151.89	164.94

Total = Sum(45)$_{1…12}$ = | 1642.7 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.55	22.34	23.06	20.1	19.29	16.64	15.42	17.7	17.91	20.87	22.78	24.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 180 | (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): | 1.6 | (48)

Temperature factor from Table 2b | 0.54 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0.86 | (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)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.86	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	220.36	194.16	203.76	182.44	178.63	159.39	152.87	168.03	167.83	189.19	200.32	214.99	(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=	220.36	194.16	203.76	182.44	178.63	159.39	152.87	168.03	167.83	189.19	200.32	214.99	

Output from water heater (annual)$_{1...12}$ | 2231.96 | (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=	96.67	85.69	91.15	83.3	82.79	75.64	74.22	79.27	78.44	86.3	89.25	94.88	(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=	147.8	147.8	147.8	147.8	147.8	147.8	147.8	147.8	147.8	147.8	147.8	147.8	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	30.74	27.3	22.21	16.81	12.57	10.61	11.46	14.9	20	25.39	29.64	31.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	336.56	340.05	331.25	312.52	288.86	266.64	251.79	248.29	257.09	275.83	299.48	321.71	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	37.78	(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=	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	-118.24	(71)

Water heating gains (Table 5)

(72)m=	129.93	127.52	122.51	115.7	111.28	105.05	99.76	106.54	108.95	116	123.96	127.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	564.57	562.21	543.3	512.37	480.05	449.64	430.35	437.08	453.39	484.56	520.42	548.17	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	12.59	x	11.28	x	0.45	x	0.7	=	31.01	(75)
Northeast	0.9x	0.77	x	12.59	x	22.97	x	0.45	x	0.7	=	63.12	(75)
Northeast	0.9x	0.77	x	12.59	x	41.38	x	0.45	x	0.7	=	113.72	(75)
Northeast	0.9x	0.77	x	12.59	x	67.96	x	0.45	x	0.7	=	186.77	(75)
Northeast	0.9x	0.77	x	12.59	x	91.35	x	0.45	x	0.7	=	251.05	(75)
Northeast	0.9x	0.77	x	12.59	x	97.38	x	0.45	x	0.7	=	267.65	(75)
Northeast	0.9x	0.77	x	12.59	x	91.1	x	0.45	x	0.7	=	250.38	(75)
Northeast	0.9x	0.77	x	12.59	x	72.63	x	0.45	x	0.7	=	199.6	(75)
Northeast	0.9x	0.77	x	12.59	x	50.42	x	0.45	x	0.7	=	138.57	(75)
Northeast	0.9x	0.77	x	12.59	x	28.07	x	0.45	x	0.7	=	77.14	(75)
Northeast	0.9x	0.77	x	12.59	x	14.2	x	0.45	x	0.7	=	39.02	(75)
Northeast	0.9x	0.77	x	12.59	x	9.21	x	0.45	x	0.7	=	25.32	(75)
Southwest	0.9x	0.77	x	16.57	x	36.79		0.45	x	0.7	=	133.09	(79)
Southwest	0.9x	0.77	x	16.57	x	62.67		0.45	x	0.7	=	226.7	(79)
Southwest	0.9x	0.77	x	16.57	x	85.75		0.45	x	0.7	=	310.18	(79)
Southwest	0.9x	0.77	x	16.57	x	106.25		0.45	x	0.7	=	384.33	(79)
Southwest	0.9x	0.77	x	16.57	x	119.01		0.45	x	0.7	=	430.48	(79)
Southwest	0.9x	0.77	x	16.57	x	118.15		0.45	x	0.7	=	427.37	(79)
Southwest	0.9x	0.77	x	16.57	x	113.91		0.45	x	0.7	=	412.03	(79)
Southwest	0.9x	0.77	x	16.57	x	104.39		0.45	x	0.7	=	377.6	(79)
Southwest	0.9x	0.77	x	16.57	x	92.85		0.45	x	0.7	=	335.86	(79)
Southwest	0.9x	0.77	x	16.57	x	69.27		0.45	x	0.7	=	250.55	(79)
Southwest	0.9x	0.77	x	16.57	x	44.07		0.45	x	0.7	=	159.41	(79)
Southwest	0.9x	0.77	x	16.57	x	31.49		0.45	x	0.7	=	113.9	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	164.1	289.82	423.9	571.09	681.53	695.01	662.4	577.2	474.43	327.69	198.43	139.22	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	728.67	852.03	967.21	1083.46	1161.58	1144.65	1092.76	1014.28	927.82	812.25	718.84	687.39	(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	0.86	0.66	0.49	0.55	0.82	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.13	20.25	20.43	20.67	20.85	20.94	20.95	20.95	20.9	20.66	20.35	20.12	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.28	20.3	20.3	20.31	20.29	20.28	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.94	0.82	0.6	0.41	0.47	0.76	0.97	1	1	(89)

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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.23	19.5	19.86	20.11	20.22	20.23	20.24	20.18	19.85	19.41	19.06	(90)

fLA = Living area ÷ (4) = 0.19 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.26	19.42	19.67	20.01	20.25	20.35	20.37	20.37	20.31	20	19.59	19.26	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.26	19.42	19.67	20.01	20.25	20.35	20.37	20.37	20.31	20	19.59	19.26	(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	0.94	0.82	0.6	0.42	0.47	0.76	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	726.8	846.61	949.69	1016.29	950.54	690.31	461	481.54	709.21	780.69	714.54	686.11	(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=	1970.26	1902.86	1717.31	1410.63	1078.94	706.93	462.74	484.83	771.34	1187.24	1593.56	1942.29	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	925.13	709.8	571.11	283.92	95.53	0	0	0	0	302.48	632.9	934.59	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4455.47 (98)

Space heating requirement in kWh/m²/year 26.98 (99)

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		341.97	(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)													
	925.13	709.8	571.11	283.92	95.53	0	0	0	0	302.48	632.9	934.59	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	270.53	207.56	167	83.03	27.93	0	0	0	0	88.45	185.07	273.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1302.87 (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)

220.36	194.16	203.76	182.44	178.63	159.39	152.87	168.03	167.83	189.19	200.32	214.99

Efficiency of water heater 282.62 (216)

DER WorkSheet: New dwelling design stage

(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	77.97	68.7	72.09	64.55	63.2	56.4	54.09	59.45	59.38	66.94	70.88	76.07

	Total = Sum(219a)$_{1...12}$ =	789.72	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1302.87	
Water heating fuel used			789.72	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		526.87		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		526.87	(231)
Electricity for lighting			542.91	(232)
Electricity generated by PVs			-730.07	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			2432.3	(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	0.519	=	676.19	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	409.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1086.06	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	273.45	(267)
Electricity for lighting	(232) x	0.519	=	281.77	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-378.91	(269)
Total CO2, kg/year		sum of (265)…(271) =		1262.36	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		7.64	(273)
EI rating (section 14)				92	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.49

Property Address: Block H - End - HT 4

Address : Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	52.62	(1a)	x	2.8	(2a)	=	147.34	(3a)
First floor	62	(1b)	x	3	(2b)	=	186	(3b)
Second floor	62	(1c)	x	3	(2c)	=	186	(3c)
Third floor	44.77	(1d)	x	3.69	(2d)	=	165.2	(3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	221.39	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	684.54	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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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

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	75.65	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	
Doors			2.31	x	1	=	2.31			(26)
Windows Type 1			15.36	x1/[1/(1.2)+ 0.04]		=	17.59			(27)
Windows Type 2			23.25	x1/[1/(1.2)+ 0.04]		=	26.62			(27)
Floor Type 1			52.62	x	0.1	=	5.262	75	3946.5	(28)
Floor Type 2			9.38	x	0.1	=	0.938	20	187.6	(28)
Walls	275.36	40.92	234.44	x	0.16	=	37.51	60	14066.4	(29)
Roof Type1	44.77	0	44.77	x	0.1	=	4.48	9	402.93	(30)
Roof Type2	17.23	0	17.23	x	0.1	=	1.72	9	155.07	(30)
Total area of elements, m²			399.36							(31)
Party wall			114.96	x	0	=	0	110	12645.6	(32)
Internal wall **			501					9	4509	(32c)
Internal floor			168.77					18	3037.86	(32d)
Internal ceiling			168.77					104.48	17633.09	(32e)

** 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) = 96.43 (33)

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Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	56584.05	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	= (34) ÷ (4) =	255.59	(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		26.11	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	122.54	(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=	76.47	75.51	74.55	69.75	68.79	63.99	63.99	63.03	65.91	68.79	70.71	72.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	199.01	198.05	197.09	192.29	191.33	186.53	186.53	185.57	188.45	191.33	193.25	195.17	

Average = $\text{Sum}(39)_{1…12}$ /12= 192.05 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.89	0.89	0.87	0.86	0.84	0.84	0.84	0.85	0.86	0.87	0.88	

Average = $\text{Sum}(40)_{1…12}$ /12= 0.87 (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 3.03 (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) + 36 106.16 (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=	116.77	112.53	108.28	104.03	99.79	95.54	95.54	99.79	104.03	108.28	112.53	116.77

Total = $\text{Sum}(44)_{1…12}$ = 1273.87 (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=	173.17	151.45	156.29	136.26	130.74	112.82	104.54	119.97	121.4	141.48	154.43	167.71

Total = $\text{Sum}(45)_{1…12}$ = 1670.25 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.98	22.72	23.44	20.44	19.61	16.92	15.68	17.99	18.21	21.22	23.17	25.16	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 180 (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): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.86 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

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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)		0.86	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	223.22	196.66	206.33	184.69	180.79	161.25	154.59	170.01	169.83	191.52	202.87	217.75	(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=	223.22	196.66	206.33	184.69	180.79	161.25	154.59	170.01	169.83	191.52	202.87	217.75	

Output from water heater (annual)1…12 — 2259.51 (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=	97.62	86.52	92	84.05	83.51	76.26	74.8	79.93	79.11	87.08	90.09	95.8	(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=	151.49	151.49	151.49	151.49	151.49	151.49	151.49	151.49	151.49	151.49	151.49	151.49	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	35.78	31.78	25.85	19.57	14.63	12.35	13.34	17.35	23.28	29.56	34.5	36.78	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	390.95	395	384.78	363.02	335.54	309.72	292.47	288.42	298.64	320.4	347.88	373.7	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	38.15	38.15	38.15	38.15	38.15	38.15	38.15	38.15	38.15	38.15	38.15	38.15	(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=	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	(71)

Water heating gains (Table 5)

(72)m=	131.2	128.75	123.66	116.74	112.24	105.91	100.53	107.43	109.88	117.04	125.13	128.76	(72)

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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	626.38	623.98	602.73	567.77	530.86	496.43	474.8	481.64	500.24	535.45	575.96	607.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	23.25	x	11.28	x	0.45	x	0.7	=	57.26	(75)
Northeast 0.9x	0.77	x	23.25	x	22.97	x	0.45	x	0.7	=	116.56	(75)
Northeast 0.9x	0.77	x	23.25	x	41.38	x	0.45	x	0.7	=	210.01	(75)
Northeast 0.9x	0.77	x	23.25	x	67.96	x	0.45	x	0.7	=	344.9	(75)
Northeast 0.9x	0.77	x	23.25	x	91.35	x	0.45	x	0.7	=	463.61	(75)
Northeast 0.9x	0.77	x	23.25	x	97.38	x	0.45	x	0.7	=	494.26	(75)
Northeast 0.9x	0.77	x	23.25	x	91.1	x	0.45	x	0.7	=	462.37	(75)
Northeast 0.9x	0.77	x	23.25	x	72.63	x	0.45	x	0.7	=	368.61	(75)
Northeast 0.9x	0.77	x	23.25	x	50.42	x	0.45	x	0.7	=	255.9	(75)
Northeast 0.9x	0.77	x	23.25	x	28.07	x	0.45	x	0.7	=	142.45	(75)
Northeast 0.9x	0.77	x	23.25	x	14.2	x	0.45	x	0.7	=	72.05	(75)
Northeast 0.9x	0.77	x	23.25	x	9.21	x	0.45	x	0.7	=	46.77	(75)
Southwest 0.9x	0.77	x	15.36	x	36.79		0.45	x	0.7	=	123.37	(79)
Southwest 0.9x	0.77	x	15.36	x	62.67		0.45	x	0.7	=	210.14	(79)
Southwest 0.9x	0.77	x	15.36	x	85.75		0.45	x	0.7	=	287.53	(79)
Southwest 0.9x	0.77	x	15.36	x	106.25		0.45	x	0.7	=	356.26	(79)
Southwest 0.9x	0.77	x	15.36	x	119.01		0.45	x	0.7	=	399.04	(79)
Southwest 0.9x	0.77	x	15.36	x	118.15		0.45	x	0.7	=	396.16	(79)
Southwest 0.9x	0.77	x	15.36	x	113.91		0.45	x	0.7	=	381.94	(79)
Southwest 0.9x	0.77	x	15.36	x	104.39		0.45	x	0.7	=	350.02	(79)
Southwest 0.9x	0.77	x	15.36	x	92.85		0.45	x	0.7	=	311.33	(79)
Southwest 0.9x	0.77	x	15.36	x	69.27		0.45	x	0.7	=	232.25	(79)
Southwest 0.9x	0.77	x	15.36	x	44.07		0.45	x	0.7	=	147.77	(79)
Southwest 0.9x	0.77	x	15.36	x	31.49		0.45	x	0.7	=	105.58	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.64	326.71	497.54	701.16	862.66	890.42	844.31	718.63	567.24	374.71	219.82	152.34	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	807.02	950.69	1100.28	1268.93	1393.52	1386.85	1319.11	1200.27	1067.48	910.16	795.78	760.03	(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	1	0.99	0.95	0.8	0.61	0.69	0.94	1	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.13	20.22	20.38	20.6	20.81	20.93	20.95	20.95	20.86	20.6	20.33	20.13	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.18	20.19	20.2	20.22	20.22	20.22	20.21	20.2	20.19	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	0.99	0.92	0.72	0.51	0.58	0.9	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.11	19.35	19.69	19.97	20.13	20.15	20.16	20.06	19.69	19.29	18.99	(90)

fLA = Living area ÷ (4) = 0.35 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.5	19.71	20.01	20.26	20.41	20.43	20.43	20.34	20.01	19.65	19.39	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.38	19.5	19.71	20.01	20.26	20.41	20.43	20.43	20.34	20.01	19.65	19.39	(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	1	1	0.99	0.93	0.74	0.54	0.61	0.91	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	806.86	950.11	1097.51	1250.63	1289.54	1029.29	709.31	735.85	966.61	904.69	795.36	759.93	(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=	3001.29	2891.62	2602.93	2135.84	1638.46	1084.04	715.05	748.39	1175.02	1799.68	2426.13	2963.73	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1632.66	1304.7	1120.03	637.35	259.59	0	0	0	0	665.88	1174.15	1639.63	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 8433.99 (98)

Space heating requirement in kWh/m²/year 38.1 (99)

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		446.94	(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)													
	1632.66	1304.7	1120.03	637.35	259.59	0	0	0	0	665.88	1174.15	1639.63	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	365.29	291.92	250.6	142.6	58.08	0	0	0	0	148.99	262.71	366.85	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1887.04 (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)

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Water heating

Output from water heater (calculated above)

223.22	196.66	206.33	184.69	180.79	161.25	154.59	170.01	169.83	191.52	202.87	217.75

Efficiency of water heater 282.62 (216)

(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	78.98	69.58	73.01	65.35	63.97	57.05	54.7	60.15	60.09	67.77	71.78	77.05

Total = Sum(219a)$_{1...12}$ = 799.47 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1887.04	
Water heating fuel used			799.47	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		897.77		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		897.77	(231)
Electricity for lighting			631.97	(232)
Electricity generated by PVs			-730.07	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			3486.18	(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	0.519	=	979.37	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	414.93	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1394.3	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	465.94	(267)
Electricity for lighting	(232)	x	0.519	=	327.99	(268)
Energy saving/generation technologies Item 1			0.519	=	-378.91	(269)
Total CO2, kg/year			sum of (265)…(271) =		1809.33	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		8.17	(273)
EI rating (section 14)					91	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.49

Property Address: Block J - Mid - HT 4

Address : Ham Close, London, TW10

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	52.62	(1a)	x	2.8	(2a)	=	147.34	(3a)
First floor	62	(1b)	x	3	(2b)	=	186	(3b)
Second floor	62	(1c)	x	3	(2c)	=	186	(3c)
Third floor	44.77	(1d)	x	3.69	(2d)	=	165.2	(3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	221.39	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	684.54	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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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

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.28	0.29	0.3	0.31	0.32	(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	
Doors			2.31	x	1	=	2.31			(26)
Windows Type 1			15.36	x1/[1/(1.2)+ 0.04]		=	17.59			(27)
Windows Type 2			23.25	x1/[1/(1.2)+ 0.04]		=	26.62			(27)
Floor Type 1			52.62	x	0.1	=	5.262	75	3946.5	(28)
Floor Type 2			9.38	x	0.1	=	0.938	20	187.6	(28)
Walls	152.7	40.92	111.78	x	0.16	=	17.88	60	6706.8	(29)
Roof Type1	44.77	0	44.77	x	0.1	=	4.48	9	402.93	(30)
Roof Type2	17.23	0	17.23	x	0.1	=	1.72	9	155.07	(30)
Total area of elements, m²			276.7							(31)
Party wall			237.62	x	0	=	0	110	26138.2	(32)
Internal wall **			501					9	4509	(32c)
Internal floor			168.77					18	3037.86	(32d)
Internal ceiling			168.77					104.48	17633.09	(32e)

** 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) = 76.8 (33)

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Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	62717.05	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	= (34) ÷ (4) =	283.29	(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		24.59	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	101.4	(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=	76.47	75.51	74.55	69.75	68.79	63.99	63.99	63.03	65.91	68.79	70.71	72.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	177.86	176.9	175.94	171.14	170.18	165.38	165.38	164.42	167.3	170.18	172.1	174.02	

Average = Sum(39)$_{1…12}$ /12= 170.9 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.8	0.79	0.77	0.77	0.75	0.75	0.74	0.76	0.77	0.78	0.79	

Average = Sum(40)$_{1…12}$ /12= 0.77 (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 — 3.03 (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 — 106.16 (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=	116.77	112.53	108.28	104.03	99.79	95.54	95.54	99.79	104.03	108.28	112.53	116.77	

Total = Sum(44)$_{1…12}$ = 1273.87 (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=	173.17	151.45	156.29	136.26	130.74	112.82	104.54	119.97	121.4	141.48	154.43	167.71	

Total = Sum(45)$_{1…12}$ = 1670.25 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.98	22.72	23.44	20.44	19.61	16.92	15.68	17.99	18.21	21.22	23.17	25.16	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 180 (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): — 1.6 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.86 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

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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)		0.86	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	223.22	196.66	206.33	184.69	180.79	161.25	154.59	170.01	169.83	191.52	202.87	217.75	(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=	223.22	196.66	206.33	184.69	180.79	161.25	154.59	170.01	169.83	191.52	202.87	217.75	

Output from water heater (annual)1…12 — 2259.51 — (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=	97.62	86.52	92	84.05	83.51	76.26	74.8	79.93	79.11	87.08	90.09	95.8	(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=	151.49	151.49	151.49	151.49	151.49	151.49	151.49	151.49	151.49	151.49	151.49	151.49	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	35.78	31.78	25.85	19.57	14.63	12.35	13.34	17.35	23.28	29.56	34.5	36.78	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	390.95	395	384.78	363.02	335.54	309.72	292.47	288.42	298.64	320.4	347.88	373.7	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	38.15	38.15	38.15	38.15	38.15	38.15	38.15	38.15	38.15	38.15	38.15	38.15	(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=	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	-121.19	(71)

Water heating gains (Table 5)

(72)m=	131.2	128.75	123.66	116.74	112.24	105.91	100.53	107.43	109.88	117.04	125.13	128.76	(72)

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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	626.38	623.98	602.73	567.77	530.86	496.43	474.8	481.64	500.24	535.45	575.96	607.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	15.36	x	11.28	x	0.45	x	0.7	=	37.83	(75)
Northeast 0.9x	0.77	x	15.36	x	22.97	x	0.45	x	0.7	=	77.01	(75)
Northeast 0.9x	0.77	x	15.36	x	41.38	x	0.45	x	0.7	=	138.74	(75)
Northeast 0.9x	0.77	x	15.36	x	67.96	x	0.45	x	0.7	=	227.86	(75)
Northeast 0.9x	0.77	x	15.36	x	91.35	x	0.45	x	0.7	=	306.28	(75)
Northeast 0.9x	0.77	x	15.36	x	97.38	x	0.45	x	0.7	=	326.53	(75)
Northeast 0.9x	0.77	x	15.36	x	91.1	x	0.45	x	0.7	=	305.46	(75)
Northeast 0.9x	0.77	x	15.36	x	72.63	x	0.45	x	0.7	=	243.52	(75)
Northeast 0.9x	0.77	x	15.36	x	50.42	x	0.45	x	0.7	=	169.06	(75)
Northeast 0.9x	0.77	x	15.36	x	28.07	x	0.45	x	0.7	=	94.11	(75)
Northeast 0.9x	0.77	x	15.36	x	14.2	x	0.45	x	0.7	=	47.6	(75)
Northeast 0.9x	0.77	x	15.36	x	9.21	x	0.45	x	0.7	=	30.9	(75)
Southwest 0.9x	0.77	x	23.25	x	36.79		0.45	x	0.7	=	186.74	(79)
Southwest 0.9x	0.77	x	23.25	x	62.67		0.45	x	0.7	=	318.09	(79)
Southwest 0.9x	0.77	x	23.25	x	85.75		0.45	x	0.7	=	435.23	(79)
Southwest 0.9x	0.77	x	23.25	x	106.25		0.45	x	0.7	=	539.27	(79)
Southwest 0.9x	0.77	x	23.25	x	119.01		0.45	x	0.7	=	604.02	(79)
Southwest 0.9x	0.77	x	23.25	x	118.15		0.45	x	0.7	=	599.65	(79)
Southwest 0.9x	0.77	x	23.25	x	113.91		0.45	x	0.7	=	578.13	(79)
Southwest 0.9x	0.77	x	23.25	x	104.39		0.45	x	0.7	=	529.82	(79)
Southwest 0.9x	0.77	x	23.25	x	92.85		0.45	x	0.7	=	471.26	(79)
Southwest 0.9x	0.77	x	23.25	x	69.27		0.45	x	0.7	=	351.56	(79)
Southwest 0.9x	0.77	x	23.25	x	44.07		0.45	x	0.7	=	223.67	(79)
Southwest 0.9x	0.77	x	23.25	x	31.49		0.45	x	0.7	=	159.81	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	224.57	395.1	573.97	767.12	910.31	926.18	883.59	773.34	640.32	445.67	271.28	190.71	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	850.96	1019.08	1176.7	1334.89	1441.17	1422.62	1358.39	1254.97	1140.56	981.12	847.23	798.39	(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	1	0.99	0.92	0.72	0.53	0.6	0.89	1	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.32	20.41	20.54	20.73	20.89	20.96	20.97	20.96	20.92	20.72	20.49	20.32	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(88)m=	20.25	20.25	20.26	20.28	20.28	20.3	20.3	20.3	20.29	20.28	20.27	20.27		(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	0.98	0.89	0.65	0.45	0.51	0.84	0.99	1	1		(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.31	19.44	19.65	19.94	20.15	20.24	20.25	20.25	20.21	19.93	19.58	19.32		(90)
										fLA = Living area ÷ (4) =			0.35	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.66	19.78	19.96	20.22	20.41	20.49	20.5	20.5	20.46	20.2	19.9	19.67	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.66	19.78	19.96	20.22	20.41	20.49	20.5	20.5	20.46	20.2	19.9	19.67	(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	1	1	0.98	0.9	0.67	0.47	0.54	0.85	0.99	1	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	850.87	1018.61	1173.79	1311.1	1295.13	959.37	644	672.26	974.86	973.81	846.91	798.34		(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=	2732.22	2631.94	2368.23	1936.68	1482	974.64	644.86	674.35	1063.53	1634.46	2202.65	2691.38		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	1399.73	1084.16	888.67	450.42	139.03	0	0	0	0	491.53	976.13	1408.42		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				6838.08	(98)
Space heating requirement in kWh/m²/year													30.89	(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		444.71	(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)														
	1399.73	1084.16	888.67	450.42	139.03	0	0	0	0	491.53	976.13	1408.42		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	314.75	243.79	199.83	101.28	31.26	0	0	0	0	110.53	219.5	316.71		
									Total (kWh/year) =Sum(211)$_{1...5,10....12}$=				1537.66	(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)

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Water heating

Output from water heater (calculated above)

223.22	196.66	206.33	184.69	180.79	161.25	154.59	170.01	169.83	191.52	202.87	217.75

Efficiency of water heater: 282.62 (216)

(217)m=

282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

78.98	69.58	73.01	65.35	63.97	57.05	54.7	60.15	60.09	67.77	71.78	77.05

Total = Sum(219a)$_{1...12}$ = 799.47 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1537.66	
Water heating fuel used			799.47	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		897.77		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		897.77	(231)
Electricity for lighting			631.97	(232)
Electricity generated by PVs			-730.07	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			3136.8	(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	0.519	=	798.05	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	414.93	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1212.97	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	465.94	(267)
Electricity for lighting	(232)	x	0.519	=	327.99	(268)
Energy saving/generation technologies Item 1			0.519	=	-378.91	(269)
Total CO2, kg/year		sum of (265)…(271) =			1628	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			7.35	(273)
EI rating (section 14)					92	(274)