DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.1.32

Property Address: Flat 1 - Baseline

Address : Flat 1, 27 West End Lane, London, NW6 4QJ

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	89.19	(1a) x	2.35	(2a) =	209.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	89.19	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		209.6	(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							3	x 10 =	30	(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) =	30	÷ (5) =	0.14	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.84999990463257	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.44	(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) =	0.37	(21)

Infiltration rate modified for monthly wind speed

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

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.42	0.44

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

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

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(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			1.92	x	1	=	1.92			(26)
Windows Type 1			3.27		x1/[1/(1.4)+ 0.04]	=	4.34			(27)
Windows Type 2			1.92		x1/[1/(1.4)+ 0.04]	=	2.55			(27)
Windows Type 3			3.65		x1/[1/(1.4)+ 0.04]	=	4.84			(27)
Windows Type 4			0.726		x1/[1/(1.4)+ 0.04]	=	0.96			(27)
Windows Type 5			4.55		x1/[1/(1.4)+ 0.04]	=	6.03			(27)
Rooflights			4.29		x1/[1/(1.4) + 0.04]	=	6.006			(27b)
Floor			89.19	x	0.13	=	11.5947			(28)
Walls Type1	82.48	20.66	61.82	x	0.18	=	11.13			(29)
Walls Type2	42.3	1.92	40.38	x	0.17	=	6.75			(29)
Roof	23.03	4.29	18.74	x	0.13	=	2.44			(30)
Total area of elements, m²			237							(31)
Party ceiling			66.16							(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) = 66.9 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 22.46 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 89.36 (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=	42.29	41.99	41.7	40.32	40.06	38.86	38.86	38.64	39.33	40.06	40.58	41.13	(38)

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

(39)m=	131.65	131.35	131.06	129.68	129.42	128.22	128.22	128	128.69	129.42	129.95	130.49	

Average = Sum(39)$_{1…12}$ /12= 129.68 (39)

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

(40)m=	1.48	1.47	1.47	1.45	1.45	1.44	1.44	1.44	1.44	1.45	1.46	1.46	

Average = Sum(40)$_{1…12}$ /12= 1.45 (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 2.61 (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 96.29 (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=	105.92	102.07	98.22	94.37	90.52	86.66	86.66	90.52	94.37	98.22	102.07	105.92	

Total = Sum(44)$_{1…12}$ = 1155.52 (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=	157.08	137.38	141.77	123.6	118.59	102.34	94.83	108.82	110.12	128.33	140.09	152.12	

Total = Sum(45)$_{1…12}$ = 1515.07 (45)

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

(46)m=	23.56	20.61	21.27	18.54	17.79	15.35	14.22	16.32	16.52	19.25	21.01	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) = 0 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	50.96	46.03	50.05	46.54	46.13	42.74	44.16	46.13	46.54	50.05	49.32	50.96	(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=	208.04	183.41	191.82	170.13	164.72	145.08	138.99	154.95	156.66	178.39	189.4	203.08	(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=	208.04	183.41	191.82	170.13	164.72	145.08	138.99	154.95	156.66	178.39	189.4	203.08	

Output from water heater (annual)$_{1...12}$ 2084.67 (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=	64.97	57.19	59.65	52.73	50.96	44.71	42.57	47.71	48.25	55.18	58.91	63.32	(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=	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	(66)

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

(67)m=	21.18	18.81	15.3	11.58	8.66	7.31	7.9	10.27	13.78	17.5	20.42	21.77	(67)

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

(68)m=	237.58	240.04	233.83	220.61	203.91	188.22	177.74	175.27	181.48	194.71	211.41	227.1	(68)

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

(69)m=	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	(71)

Water heating gains (Table 5)

(72)m=	87.32	85.1	80.18	73.24	68.5	62.1	57.22	64.13	67.01	74.17	81.82	85.11	(72)

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

(73)m=	411.3	409.17	394.52	370.64	346.29	322.85	308.07	314.89	327.49	351.6	378.86	399.19	(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	0.73	x	11.28	x	0.76	x	0.7	=	3.02	(75)
Northeast	0.9x	0.77	x	0.73	x	22.97	x	0.76	x	0.7	=	6.15	(75)
Northeast	0.9x	0.77	x	0.73	x	41.38	x	0.76	x	0.7	=	11.08	(75)
Northeast	0.9x	0.77	x	0.73	x	67.96	x	0.76	x	0.7	=	18.19	(75)
Northeast	0.9x	0.77	x	0.73	x	91.35	x	0.76	x	0.7	=	24.45	(75)
Northeast	0.9x	0.77	x	0.73	x	97.38	x	0.76	x	0.7	=	26.07	(75)
Northeast	0.9x	0.77	x	0.73	x	91.1	x	0.76	x	0.7	=	24.38	(75)
Northeast	0.9x	0.77	x	0.73	x	72.63	x	0.76	x	0.7	=	19.44	(75)
Northeast	0.9x	0.77	x	0.73	x	50.42	x	0.76	x	0.7	=	13.5	(75)
Northeast	0.9x	0.77	x	0.73	x	28.07	x	0.76	x	0.7	=	7.51	(75)
Northeast	0.9x	0.77	x	0.73	x	14.2	x	0.76	x	0.7	=	3.8	(75)
Northeast	0.9x	0.77	x	0.73	x	9.21	x	0.76	x	0.7	=	2.47	(75)
Southeast	0.9x	0.77	x	4.55	x	36.79	x	0.76	x	0.7	=	61.72	(77)
Southeast	0.9x	0.77	x	4.55	x	62.67	x	0.76	x	0.7	=	105.13	(77)
Southeast	0.9x	0.77	x	4.55	x	85.75	x	0.76	x	0.7	=	143.85	(77)
Southeast	0.9x	0.77	x	4.55	x	106.25	x	0.76	x	0.7	=	178.23	(77)
Southeast	0.9x	0.77	x	4.55	x	119.01	x	0.76	x	0.7	=	199.64	(77)
Southeast	0.9x	0.77	x	4.55	x	118.15	x	0.76	x	0.7	=	198.19	(77)
Southeast	0.9x	0.77	x	4.55	x	113.91	x	0.76	x	0.7	=	191.08	(77)
Southeast	0.9x	0.77	x	4.55	x	104.39	x	0.76	x	0.7	=	175.11	(77)
Southeast	0.9x	0.77	x	4.55	x	92.85	x	0.76	x	0.7	=	155.76	(77)
Southeast	0.9x	0.77	x	4.55	x	69.27	x	0.76	x	0.7	=	116.19	(77)
Southeast	0.9x	0.77	x	4.55	x	44.07	x	0.76	x	0.7	=	73.93	(77)
Southeast	0.9x	0.77	x	4.55	x	31.49	x	0.76	x	0.7	=	52.82	(77)
Southwest	0.9x	0.77	x	3.65	x	36.79		0.76	x	0.7	=	49.51	(79)
Southwest	0.9x	0.77	x	3.65	x	62.67		0.76	x	0.7	=	84.34	(79)
Southwest	0.9x	0.77	x	3.65	x	85.75		0.76	x	0.7	=	115.39	(79)
Southwest	0.9x	0.77	x	3.65	x	106.25		0.76	x	0.7	=	142.98	(79)
Southwest	0.9x	0.77	x	3.65	x	119.01		0.76	x	0.7	=	160.15	(79)
Southwest	0.9x	0.77	x	3.65	x	118.15		0.76	x	0.7	=	158.99	(79)
Southwest	0.9x	0.77	x	3.65	x	113.91		0.76	x	0.7	=	153.28	(79)
Southwest	0.9x	0.77	x	3.65	x	104.39		0.76	x	0.7	=	140.47	(79)
Southwest	0.9x	0.77	x	3.65	x	92.85		0.76	x	0.7	=	124.95	(79)
Southwest	0.9x	0.77	x	3.65	x	69.27		0.76	x	0.7	=	93.21	(79)
Southwest	0.9x	0.77	x	3.65	x	44.07		0.76	x	0.7	=	59.3	(79)
Southwest	0.9x	0.77	x	3.65	x	31.49		0.76	x	0.7	=	42.37	(79)
Northwest	0.9x	0.77	x	3.27	x	11.28	x	0.76	x	0.7	=	40.81	(81)
Northwest	0.9x	0.77	x	1.92	x	11.28	x	0.76	x	0.7	=	7.99	(81)
Northwest	0.9x	0.77	x	3.27	x	22.97	x	0.76	x	0.7	=	83.06	(81)

Northwest	0.9x	0.77	x	1.92	x	22.97	x	0.76	x	0.7	=	16.26	(81)
Northwest	0.9x	0.77	x	3.27	x	41.38	x	0.76	x	0.7	=	149.66	(81)
Northwest	0.9x	0.77	x	1.92	x	41.38	x	0.76	x	0.7	=	29.29	(81)
Northwest	0.9x	0.77	x	3.27	x	67.96	x	0.76	x	0.7	=	245.78	(81)
Northwest	0.9x	0.77	x	1.92	x	67.96	x	0.76	x	0.7	=	48.1	(81)
Northwest	0.9x	0.77	x	3.27	x	91.35	x	0.76	x	0.7	=	330.37	(81)
Northwest	0.9x	0.77	x	1.92	x	91.35	x	0.76	x	0.7	=	64.66	(81)
Northwest	0.9x	0.77	x	3.27	x	97.38	x	0.76	x	0.7	=	352.21	(81)
Northwest	0.9x	0.77	x	1.92	x	97.38	x	0.76	x	0.7	=	68.93	(81)
Northwest	0.9x	0.77	x	3.27	x	91.1	x	0.76	x	0.7	=	329.49	(81)
Northwest	0.9x	0.77	x	1.92	x	91.1	x	0.76	x	0.7	=	64.49	(81)
Northwest	0.9x	0.77	x	3.27	x	72.63	x	0.76	x	0.7	=	262.67	(81)
Northwest	0.9x	0.77	x	1.92	x	72.63	x	0.76	x	0.7	=	51.41	(81)
Northwest	0.9x	0.77	x	3.27	x	50.42	x	0.76	x	0.7	=	182.36	(81)
Northwest	0.9x	0.77	x	1.92	x	50.42	x	0.76	x	0.7	=	35.69	(81)
Northwest	0.9x	0.77	x	3.27	x	28.07	x	0.76	x	0.7	=	101.51	(81)
Northwest	0.9x	0.77	x	1.92	x	28.07	x	0.76	x	0.7	=	19.87	(81)
Northwest	0.9x	0.77	x	3.27	x	14.2	x	0.76	x	0.7	=	51.35	(81)
Northwest	0.9x	0.77	x	1.92	x	14.2	x	0.76	x	0.7	=	10.05	(81)
Northwest	0.9x	0.77	x	3.27	x	9.21	x	0.76	x	0.7	=	33.33	(81)
Northwest	0.9x	0.77	x	1.92	x	9.21	x	0.76	x	0.7	=	6.52	(81)
Rooflights	0.9x	1	x	4.29	x	26	x	0.76	x	0.7	=	53.41	(82)
Rooflights	0.9x	1	x	4.29	x	54	x	0.76	x	0.7	=	110.92	(82)
Rooflights	0.9x	1	x	4.29	x	96	x	0.76	x	0.7	=	197.19	(82)
Rooflights	0.9x	1	x	4.29	x	150	x	0.76	x	0.7	=	308.11	(82)
Rooflights	0.9x	1	x	4.29	x	192	x	0.76	x	0.7	=	394.38	(82)
Rooflights	0.9x	1	x	4.29	x	200	x	0.76	x	0.7	=	410.81	(82)
Rooflights	0.9x	1	x	4.29	x	189	x	0.76	x	0.7	=	388.22	(82)
Rooflights	0.9x	1	x	4.29	x	157	x	0.76	x	0.7	=	322.49	(82)
Rooflights	0.9x	1	x	4.29	x	115	x	0.76	x	0.7	=	236.22	(82)
Rooflights	0.9x	1	x	4.29	x	66	x	0.76	x	0.7	=	135.57	(82)
Rooflights	0.9x	1	x	4.29	x	33	x	0.76	x	0.7	=	67.78	(82)
Rooflights	0.9x	1	x	4.29	x	21	x	0.76	x	0.7	=	43.14	(82)

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

(83)m=	216.45	405.86	646.45	941.39	1173.65	1215.21	1150.94	971.59	748.46	473.86	266.21	180.64	(83)

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

(84)m=	627.75	815.03	1040.98	1312.03	1519.93	1538.05	1459.01	1286.48	1075.96	825.46	645.07	579.83	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.96	0.87	0.7	0.52	0.38	0.45	0.72	0.95	0.99	1	(86)

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

(87)m=	19.44	19.7	20.1	20.58	20.87	20.97	20.99	20.99	20.89	20.44	19.84	19.39	(87)

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

(88)m=	19.71	19.71	19.71	19.72	19.72	19.73	19.73	19.74	19.73	19.72	19.72	19.72	(88)

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

(89)m=	0.99	0.98	0.95	0.83	0.63	0.42	0.27	0.33	0.63	0.92	0.99	1	(89)

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

(90)m=	17.66	18.04	18.63	19.27	19.61	19.72	19.73	19.73	19.66	19.11	18.26	17.6	(90)

fLA = Living area ÷ (4) = 0.34 (91)

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

(92)m=	18.27	18.61	19.13	19.71	20.04	20.15	20.16	20.16	20.08	19.56	18.79	18.21	(92)

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

(93)m=	18.27	18.61	19.13	19.71	20.04	20.15	20.16	20.16	20.08	19.56	18.79	18.21	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.83	0.65	0.45	0.31	0.37	0.65	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	622.88	798.02	978.92	1092.9	989.51	696.07	454.39	476.52	704.41	756.39	634.59	576.51	(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=	1838.64	1800.37	1655.14	1402.35	1079.19	711.07	456.73	481.27	769.02	1159.7	1519.52	1828.53	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	904.53	673.58	503.11	222.81	66.72	0	0	0	0	300.06	637.15	931.5	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4239.45 (98)

Space heating requirement in kWh/m²/year 47.53 (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		89.8	(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)													
	904.53	673.58	503.11	222.81	66.72	0	0	0	0	300.06	637.15	931.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1007.27	750.08	560.25	248.12	74.3	0	0	0	0	334.14	709.52	1037.31	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4720.99 (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)

208.04	183.41	191.82	170.13	164.72	145.08	138.99	154.95	156.66	178.39	189.4	203.08

Efficiency of water heater 80.5 (216)

(217)m=	87.9	87.63	87.02	85.52	82.98	80.5	80.5	80.5	80.5	86.09	87.48	87.98	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	236.67	209.29	220.42	198.94	198.51	180.22	172.66	192.48	194.6	207.2	216.5	230.83

Total = Sum(219a)$_{1...12}$ = 2458.33 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		4720.99	
Water heating fuel used		2458.33	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	30	(231)
Electricity for lighting		374.05	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1019.73	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	531	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1550.73	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	15.57	(267)
Electricity for lighting	(232) x	0.519	=	194.13	(268)
Total CO2, kg/year		sum of (265)…(271) =		1760.44	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		19.74	(273)
EI rating (section 14)				82	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.1.32

Property Address: Flat 4 - Baseline

Address : Flat 4, 27 West End Lane, London, NW6 4QJ

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.08	(1a) x	2.35	(2a) =	122.39	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.08	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	122.39	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(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		5.84999990463257	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.46	(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) =	0.39	(21)

Infiltration rate modified for monthly wind speed

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

0.49	0.48	0.47	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.44	0.46

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.58	0.59	0.6	0.6	(24d)

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

(25)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.58	0.59	0.6	0.6	(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			1.92	x	1	=	1.92			(26)
Windows Type 1			1	x1/[1/(1.4)+ 0.04]		=	1.33			(27)
Windows Type 2			13.43	x1/[1/(1.4)+ 0.04]		=	17.8			(27)
Floor Type 1			0.69	x	0.13	=	0.0897			(28)
Floor Type 2			12.03	x	0.13	=	1.5639			(28)
Walls Type1	62	14.43	47.57	x	0.18	=	8.56			(29)
Walls Type2	15.75	1.92	13.83	x	0.17	=	2.31			(29)
Total area of elements, m²			90.47							(31)
Party wall			9.1	x	0	=	0			(32)
Party floor			42.99							(32a)
Party ceiling			52.08							(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) =	33.58	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		15.14	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	48.71	(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=	25.12	24.93	24.74	23.86	23.7	22.93	22.93	22.79	23.23	23.7	24.03	24.38	(38)

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

(39)m=	73.84	73.65	73.46	72.58	72.41	71.65	71.65	71.5	71.94	72.41	72.75	73.1	

Average = Sum(39)$_{1\ldots12}$ /12= 72.58 (39)

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

(40)m=	1.42	1.41	1.41	1.39	1.39	1.38	1.38	1.37	1.38	1.39	1.4	1.4	

Average = Sum(40)$_{1\ldots12}$ /12= 1.39 (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 1.75 (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 75.8 (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=	83.38	80.34	77.31	74.28	71.25	68.22	68.22	71.25	74.28	77.31	80.34	83.38	

Total = Sum(44)$_{1\ldots12}$ = 909.56 (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=	123.64	108.14	111.59	97.29	93.35	80.55	74.64	85.66	86.68	101.02	110.27	119.74	

Total = Sum(45)$_{1\ldots12}$ = 1192.57 (45)

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

(46)m=	18.55	16.22	16.74	14.59	14	12.08	11.2	12.85	13	15.15	16.54	17.96	(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) = 0 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	42.49	36.98	39.4	36.63	36.31	33.64	34.76	36.31	36.63	39.4	39.62	42.49	(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=	166.13	145.12	150.99	133.92	129.66	114.2	109.41	121.96	123.31	140.41	149.89	162.23	(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=	166.13	145.12	150.99	133.92	129.66	114.2	109.41	121.96	123.31	140.41	149.89	162.23

Output from water heater (annual)$_{1…12}$ — 1647.23 (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=	51.73	45.2	46.95	41.51	40.12	35.19	33.51	37.56	37.98	43.44	46.57	50.44	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	(66)

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

(67)m=	13.61	12.09	9.83	7.44	5.56	4.7	5.07	6.6	8.85	11.24	13.12	13.99	(67)

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

(68)m=	152.63	154.22	150.23	141.73	131	120.92	114.19	112.6	116.6	125.09	135.82	145.9	(68)

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

(69)m=	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	(71)

Water heating gains (Table 5)

(72)m=	69.53	67.26	63.11	57.65	53.92	48.88	45.04	50.48	52.75	58.38	64.68	67.79	(72)

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

(73)m=	288.05	285.84	275.44	259.09	242.76	226.77	216.57	221.95	230.47	246.99	265.89	279.95	(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	x	11.28	x	0.76	x	0.7	=	4.16	(75)
Northeast 0.9x	0.77	x	1	x	22.97	x	0.76	x	0.7	=	8.47	(75)
Northeast 0.9x	0.77	x	1	x	41.38	x	0.76	x	0.7	=	15.26	(75)
Northeast 0.9x	0.77	x	1	x	67.96	x	0.76	x	0.7	=	25.05	(75)
Northeast 0.9x	0.77	x	1	x	91.35	x	0.76	x	0.7	=	33.68	(75)
Northeast 0.9x	0.77	x	1	x	97.38	x	0.76	x	0.7	=	35.9	(75)
Northeast 0.9x	0.77	x	1	x	91.1	x	0.76	x	0.7	=	33.59	(75)
Northeast 0.9x	0.77	x	1	x	72.63	x	0.76	x	0.7	=	26.78	(75)
Northeast 0.9x	0.77	x	1	x	50.42	x	0.76	x	0.7	=	18.59	(75)
Northeast 0.9x	0.77	x	1	x	28.07	x	0.76	x	0.7	=	10.35	(75)
Northeast 0.9x	0.77	x	1	x	14.2	x	0.76	x	0.7	=	5.23	(75)
Northeast 0.9x	0.77	x	1	x	9.21	x	0.76	x	0.7	=	3.4	(75)
Southeast 0.9x	0.77	x	13.43	x	36.79	x	0.76	x	0.7	=	182.18	(77)
Southeast 0.9x	0.77	x	13.43	x	62.67	x	0.76	x	0.7	=	310.32	(77)
Southeast 0.9x	0.77	x	13.43	x	85.75	x	0.76	x	0.7	=	424.59	(77)
Southeast 0.9x	0.77	x	13.43	x	106.25	x	0.76	x	0.7	=	526.09	(77)
Southeast 0.9x	0.77	x	13.43	x	119.01	x	0.76	x	0.7	=	589.26	(77)
Southeast 0.9x	0.77	x	13.43	x	118.15	x	0.76	x	0.7	=	585	(77)
Southeast 0.9x	0.77	x	13.43	x	113.91	x	0.76	x	0.7	=	564	(77)
Southeast 0.9x	0.77	x	13.43	x	104.39	x	0.76	x	0.7	=	516.87	(77)
Southeast 0.9x	0.77	x	13.43	x	92.85	x	0.76	x	0.7	=	459.74	(77)
Southeast 0.9x	0.77	x	13.43	x	69.27	x	0.76	x	0.7	=	342.97	(77)
Southeast 0.9x	0.77	x	13.43	x	44.07	x	0.76	x	0.7	=	218.21	(77)
Southeast 0.9x	0.77	x	13.43	x	31.49	x	0.76	x	0.7	=	155.91	(77)

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

(83)m=	186.34	318.78	439.84	551.14	622.94	620.9	597.59	543.65	478.33	353.31	223.44	159.3	(83)

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

(84)m=	474.38	604.62	715.28	810.23	865.69	847.67	814.16	765.6	708.8	600.3	489.33	439.25	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.93	0.84	0.7	0.52	0.38	0.42	0.65	0.89	0.98	0.99	(86)

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

(87)m=	19.69	19.97	20.31	20.66	20.88	20.97	20.99	20.99	20.94	20.62	20.08	19.63	(87)

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

(88)m=	19.75	19.75	19.76	19.77	19.77	19.78	19.78	19.78	19.78	19.77	19.77	19.76	(88)

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

(89)m=	0.99	0.96	0.91	0.8	0.63	0.43	0.28	0.31	0.55	0.85	0.97	0.99	(89)

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

(90)m=	18.05	18.46	18.94	19.41	19.67	19.77	19.78	19.78	19.74	19.38	18.63	17.99	(90)

fLA = Living area ÷ (4) = 0.59 (91)

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

(92)m=	19.01	19.35	19.75	20.15	20.38	20.48	20.49	20.49	20.44	20.11	19.48	18.95	(92)

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

(93)m=	19.01	19.35	19.75	20.15	20.38	20.48	20.49	20.49	20.44	20.11	19.48	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=	0.98	0.96	0.91	0.82	0.67	0.48	0.34	0.38	0.61	0.86	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	466.49	580.06	652.16	660.45	576.02	410.75	277.21	289.87	429.74	518.43	472.61	433.72	(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=	1086.37	1064.05	973.22	816.33	628.67	420.97	278.93	292.58	456.11	688.73	900.82	1078.44	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	461.19	325.24	238.87	112.24	39.17	0	0	0	0	126.71	308.31	479.67	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2091.4 (98)

Space heating requirement in kWh/m²/year 40.16 (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		89.8	(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)													
	461.19	325.24	238.87	112.24	39.17	0	0	0	0	126.71	308.31	479.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	513.58	362.18	266	124.99	43.62	0	0	0	0	141.1	343.33	534.15	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2328.95 (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)

166.13	145.12	150.99	133.92	129.66	114.2	109.41	121.96	123.31	140.41	149.89	162.23

Efficiency of water heater 80.5 (216)

(217)m=	87.13	86.71	85.95	84.49	82.48	80.5	80.5	80.5	80.5	84.66	86.53	87.25	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	190.66	167.36	175.66	158.5	157.2	141.86	135.91	151.51	153.18	165.86	173.22	185.93

Total = Sum(219a)$_{1...12}$ = 1956.86 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2328.95	
Water heating fuel used			1956.86	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		30	(231)
Electricity for lighting			240.31	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	503.05	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	422.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =				925.73	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	15.57	(267)
Electricity for lighting	(232)	x	0.519	=	124.72	(268)
Total CO2, kg/year			sum of (265)…(271) =		1066.02	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		20.47	(273)
EI rating (section 14)					85	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.1.32

Property Address: Flat 5 - Baseline

Address : Flat 5, 27 West End Lane, London, NW6 4QJ

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.82	(1a) x	2.35	(2a) =	117.08	(3a)
First floor	55.95	(1b) x	2.35	(2b) =	131.48	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.77	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	248.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.08	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.84999990463257	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.37	(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) =	0.32	(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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.92	x	1	=	1.92			(26)
Windows Type 1			5.88	x1/[1/(1.4)+ 0.04]		=	7.8			(27)
Windows Type 2			5.508	x1/[1/(1.4)+ 0.04]		=	7.3			(27)
Windows Type 3			20.08	x1/[1/(1.4)+ 0.04]		=	26.62			(27)
Windows Type 4			8.56	x1/[1/(1.4)+ 0.04]		=	11.35			(27)
Rooflights			11.91	x1/[1/(1.4) + 0.04]		=	16.674			(27b)
Floor Type 1			16.24	x	0.13	=	2.1112			(28)
Floor Type 2			0.22	x	0.13	=	0.0286			(28)
Walls Type1	126.43	40.03	86.4	x	0.18	=	15.55			(29)
Walls Type2	20.49	1.92	18.57	x	0.17	=	3.1			(29)
Roof	80.2	23.82	56.38	x	0.13	=	7.33			(30)
Total area of elements, m²			243.58							(31)
Party wall			5.78	x	0	=	0			(32)
Party floor			62.51							(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) =	114.69	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		22.83	(36)
if details of thermal bridging are not known (36) = 0.15 x (31)			
Total fabric heat loss	(33) + (36) =	137.52	(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=	47.71	47.45	47.2	46	45.78	44.73	44.73	44.54	45.13	45.78	46.23	46.7	(38)

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

(39)m=	185.23	184.97	184.72	183.52	183.3	182.25	182.25	182.06	182.65	183.3	183.75	184.22	

Average = Sum(39)$_{1…12}$ /12= 183.52 (39)

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

(40)m=	1.75	1.75	1.75	1.74	1.73	1.72	1.72	1.72	1.73	1.73	1.74	1.74	

Average = Sum(40)$_{1…12}$ /12= 1.74 (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 2.79 (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) + 36 100.39 (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=	110.43	106.41	102.4	98.38	94.37	90.35	90.35	94.37	98.38	102.4	106.41	110.43	

Total = Sum(44)$_{1…12}$ = 1204.67 (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=	163.76	143.23	147.8	128.85	123.64	106.69	98.86	113.45	114.8	133.79	146.04	158.59	

Total = Sum(45)$_{1…12}$ = 1579.51 (45)

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

(46)m=	24.56	21.48	22.17	19.33	18.55	16	14.83	17.02	17.22	20.07	21.91	23.79	(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) =	0	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	50.96	46.03	50.96	48.52	48.09	44.56	46.04	48.09	48.52	50.96	49.32	50.96	(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=	214.72	189.25	198.76	177.37	171.73	151.25	144.91	161.54	163.32	184.75	195.36	209.55	(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=	214.72	189.25	198.76	177.37	171.73	151.25	144.91	161.54	163.32	184.75	195.36	209.55

Output from water heater (annual)$_{1...12}$ 2162.5 (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=	67.19	59.13	61.88	54.97	53.13	46.61	44.38	49.74	50.3	57.23	60.89	65.47	(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=	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	(66)

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

(67)m=	23.65	21.01	17.09	12.94	9.67	8.16	8.82	11.47	15.39	19.54	22.81	24.31	(67)

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

(68)m=	265.33	268.09	261.15	246.38	227.73	210.21	198.5	195.75	202.69	217.46	236.1	253.63	(68)

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

(69)m=	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	(71)

Water heating gains (Table 5)

(72)m=	90.31	87.99	83.18	76.35	71.41	64.74	59.65	66.86	69.86	76.92	84.57	88	(72)

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

(73)m=	447.1	444.89	429.21	403.47	376.62	350.92	334.78	341.88	355.74	381.72	411.28	433.74	(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	5.88	x	11.28	x	0.76	x	0.7	=	24.46	(75)
Northeast	0.9x	0.77	x	5.88	x	22.97	x	0.76	x	0.7	=	49.79	(75)
Northeast	0.9x	0.77	x	5.88	x	41.38	x	0.76	x	0.7	=	89.7	(75)
Northeast	0.9x	0.77	x	5.88	x	67.96	x	0.76	x	0.7	=	147.32	(75)
Northeast	0.9x	0.77	x	5.88	x	91.35	x	0.76	x	0.7	=	198.02	(75)
Northeast	0.9x	0.77	x	5.88	x	97.38	x	0.76	x	0.7	=	211.11	(75)
Northeast	0.9x	0.77	x	5.88	x	91.1	x	0.76	x	0.7	=	197.49	(75)
Northeast	0.9x	0.77	x	5.88	x	72.63	x	0.76	x	0.7	=	157.44	(75)
Northeast	0.9x	0.77	x	5.88	x	50.42	x	0.76	x	0.7	=	109.3	(75)
Northeast	0.9x	0.77	x	5.88	x	28.07	x	0.76	x	0.7	=	60.84	(75)
Northeast	0.9x	0.77	x	5.88	x	14.2	x	0.76	x	0.7	=	30.78	(75)
Northeast	0.9x	0.77	x	5.88	x	9.21	x	0.76	x	0.7	=	19.97	(75)
Southeast	0.9x	0.77	x	5.51	x	36.79	x	0.76	x	0.7	=	74.72	(77)
Southeast	0.9x	0.77	x	5.51	x	62.67	x	0.76	x	0.7	=	127.27	(77)
Southeast	0.9x	0.77	x	5.51	x	85.75	x	0.76	x	0.7	=	174.14	(77)
Southeast	0.9x	0.77	x	5.51	x	106.25	x	0.76	x	0.7	=	215.76	(77)
Southeast	0.9x	0.77	x	5.51	x	119.01	x	0.76	x	0.7	=	241.67	(77)
Southeast	0.9x	0.77	x	5.51	x	118.15	x	0.76	x	0.7	=	239.92	(77)
Southeast	0.9x	0.77	x	5.51	x	113.91	x	0.76	x	0.7	=	231.31	(77)
Southeast	0.9x	0.77	x	5.51	x	104.39	x	0.76	x	0.7	=	211.98	(77)
Southeast	0.9x	0.77	x	5.51	x	92.85	x	0.76	x	0.7	=	188.55	(77)
Southeast	0.9x	0.77	x	5.51	x	69.27	x	0.76	x	0.7	=	140.66	(77)
Southeast	0.9x	0.77	x	5.51	x	44.07	x	0.76	x	0.7	=	89.49	(77)
Southeast	0.9x	0.77	x	5.51	x	31.49	x	0.76	x	0.7	=	63.94	(77)
Southwest	0.9x	0.77	x	8.56	x	36.79		0.76	x	0.7	=	116.12	(79)
Southwest	0.9x	0.77	x	8.56	x	62.67		0.76	x	0.7	=	197.79	(79)
Southwest	0.9x	0.77	x	8.56	x	85.75		0.76	x	0.7	=	270.62	(79)
Southwest	0.9x	0.77	x	8.56	x	106.25		0.76	x	0.7	=	335.32	(79)
Southwest	0.9x	0.77	x	8.56	x	119.01		0.76	x	0.7	=	375.58	(79)
Southwest	0.9x	0.77	x	8.56	x	118.15		0.76	x	0.7	=	372.87	(79)
Southwest	0.9x	0.77	x	8.56	x	113.91		0.76	x	0.7	=	359.48	(79)
Southwest	0.9x	0.77	x	8.56	x	104.39		0.76	x	0.7	=	329.44	(79)
Southwest	0.9x	0.77	x	8.56	x	92.85		0.76	x	0.7	=	293.03	(79)
Southwest	0.9x	0.77	x	8.56	x	69.27		0.76	x	0.7	=	218.6	(79)
Southwest	0.9x	0.77	x	8.56	x	44.07		0.76	x	0.7	=	139.08	(79)
Southwest	0.9x	0.77	x	8.56	x	31.49		0.76	x	0.7	=	99.37	(79)
Northwest	0.9x	0.77	x	20.08	x	11.28	x	0.76	x	0.7	=	83.53	(81)
Northwest	0.9x	0.77	x	20.08	x	22.97	x	0.76	x	0.7	=	170.02	(81)
Northwest	0.9x	0.77	x	20.08	x	41.38	x	0.76	x	0.7	=	306.33	(81)

Northwest	0.9x	0.77	x	20.08	x	67.96	x	0.76	x	0.7	=	503.08	(81)
Northwest	0.9x	0.77	x	20.08	x	91.35	x	0.76	x	0.7	=	676.24	(81)
Northwest	0.9x	0.77	x	20.08	x	97.38	x	0.76	x	0.7	=	720.94	(81)
Northwest	0.9x	0.77	x	20.08	x	91.1	x	0.76	x	0.7	=	674.42	(81)
Northwest	0.9x	0.77	x	20.08	x	72.63	x	0.76	x	0.7	=	537.66	(81)
Northwest	0.9x	0.77	x	20.08	x	50.42	x	0.76	x	0.7	=	373.26	(81)
Northwest	0.9x	0.77	x	20.08	x	28.07	x	0.76	x	0.7	=	207.78	(81)
Northwest	0.9x	0.77	x	20.08	x	14.2	x	0.76	x	0.7	=	105.1	(81)
Northwest	0.9x	0.77	x	20.08	x	9.21	x	0.76	x	0.7	=	68.21	(81)
Rooflights	0.9x	1	x	11.91	x	26	x	0.76	x	0.7	=	296.53	(82)
Rooflights	0.9x	1	x	11.91	x	54	x	0.76	x	0.7	=	615.87	(82)
Rooflights	0.9x	1	x	11.91	x	96	x	0.76	x	0.7	=	1094.88	(82)
Rooflights	0.9x	1	x	11.91	x	150	x	0.76	x	0.7	=	1710.75	(82)
Rooflights	0.9x	1	x	11.91	x	192	x	0.76	x	0.7	=	2189.76	(82)
Rooflights	0.9x	1	x	11.91	x	200	x	0.76	x	0.7	=	2281	(82)
Rooflights	0.9x	1	x	11.91	x	189	x	0.76	x	0.7	=	2155.55	(82)
Rooflights	0.9x	1	x	11.91	x	157	x	0.76	x	0.7	=	1790.59	(82)
Rooflights	0.9x	1	x	11.91	x	115	x	0.76	x	0.7	=	1311.58	(82)
Rooflights	0.9x	1	x	11.91	x	66	x	0.76	x	0.7	=	752.73	(82)
Rooflights	0.9x	1	x	11.91	x	33	x	0.76	x	0.7	=	376.37	(82)
Rooflights	0.9x	1	x	11.91	x	21	x	0.76	x	0.7	=	239.51	(82)

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

(83)m=	595.35	1160.74	1935.67	2912.22	3681.27	3825.84	3618.26	3027.11	2275.72	1380.62	740.81	491.01	(83)

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

(84)m=	1042.45	1605.63	2364.88	3315.69	4057.89	4176.76	3953.03	3368.99	2631.46	1762.33	1152.09	924.75	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.95	0.83	0.61	0.41	0.28	0.2	0.25	0.46	0.82	0.97	0.99	(86)

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

(87)m=	19.35	19.84	20.43	20.84	20.97	20.99	21	21	20.96	20.62	19.85	19.25	(87)

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

(88)m=	19.5	19.51	19.51	19.52	19.52	19.52	19.52	19.53	19.52	19.52	19.51	19.51	(88)

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

(89)m=	0.98	0.93	0.79	0.55	0.35	0.21	0.13	0.17	0.37	0.76	0.96	0.99	(89)

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

(90)m=	17.4	18.1	18.88	19.37	19.49	19.52	19.52	19.52	19.5	19.16	18.13	17.27	(90)

fLA = Living area ÷ (4) = 0.43 (91)

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

(92)m=	18.24	18.84	19.55	20	20.13	20.15	20.16	20.16	20.13	19.79	18.87	18.12	(92)

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

(93)m=	18.24	18.84	19.55	20	20.13	20.15	20.16	20.16	20.13	19.79	18.87	18.12	(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=	0.98	0.92	0.79	0.57	0.37	0.24	0.16	0.2	0.41	0.77	0.95	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1019.28	1484.63	1873.79	1890.48	1516.47	1007.95	647.52	682.38	1074.82	1353.06	1095.52	910.46	(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=	2581.83	2578.83	2409.97	2037.14	1544.34	1012.08	648.21	683.9	1101.2	1684.2	2162.21	2564.94	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1162.53	735.31	398.92	105.59	20.73	0	0	0	0	246.37	768.02	1230.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4668.39 (98)

Space heating requirement in kWh/m²/year 44.14 (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		89.8	(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)													
	1162.53	735.31	398.92	105.59	20.73	0	0	0	0	246.37	768.02	1230.93	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1294.58	818.83	444.23	117.58	23.09	0	0	0	0	274.35	855.25	1370.74	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 5198.65 (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)

	214.72	189.25	198.76	177.37	171.73	151.25	144.91	161.54	163.32	184.75	195.36	209.55	
Efficiency of water heater												80.5	(216)
(217)m=	88.21	87.73	86.48	83.74	81.41	80.5	80.5	80.5	80.5	85.56	87.74	88.32	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.42	215.73	229.84	211.82	210.94	187.88	180.01	200.67	202.88	215.92	222.65	237.28

Total = Sum(219a)$_{1...12}$ = 2559.03 (219)

DER WorkSheet: New dwelling design stage

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			5198.65	
Water heating fuel used			2559.03	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		30	(231)
Electricity for lighting			417.75	(232)

12a. CO_2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating (main system 1)	(211)	x	0.216	=	1122.91	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	552.75	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1675.66	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	15.57	(267)
Electricity for lighting	(232)	x	0.519	=	216.81	(268)
Total CO_2, kg/year			sum of (265)…(271) =		1908.04	(272)
Dwelling CO_2 Emission Rate			(272) ÷ (4) =		18.04	(273)
EI rating (section 14)					83	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.1.32

Property Address: Flat 1 - Lean

Address : Flat 1, 27 West End Lane, London, NW6 4QJ

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	89.19	(1a) x	2.35	(2a) =	209.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	89.19	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		209.6	(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							3	x 10 =	30	(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) =	30	÷ (5) =	0.14	(8)

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

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)	0.34	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.29	(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

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

0.37	0.36	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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			1.92	x	1	=	1.92			(26)
Windows Type 1			3.27	x1/[1/(1.4)+ 0.04]		=	4.34			(27)
Windows Type 2			1.92	x1/[1/(1.4)+ 0.04]		=	2.55			(27)
Windows Type 3			3.65	x1/[1/(1.4)+ 0.04]		=	4.84			(27)
Windows Type 4			0.726	x1/[1/(1.4)+ 0.04]		=	0.96			(27)
Windows Type 5			4.55	x1/[1/(1.4)+ 0.04]		=	6.03			(27)
Rooflights			4.29	x1/[1/(1.4) + 0.04]		=	6.006			(27b)
Floor			89.19	x	0.13	=	11.5947			(28)
Walls Type1	82.48	20.66	61.82	x	0.17	=	10.51			(29)
Walls Type2	42.3	1.92	40.38	x	0.16	=	6.4			(29)
Roof	23.03	4.29	18.74	x	0.13	=	2.44			(30)
Total area of elements, m²			237							(31)
Party ceiling			66.16							(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) = 65.93 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 12.49 (36) *if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 78.42 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.37	39.18	39	38.14	37.98	37.24	37.24	37.1	37.53	37.98	38.31	38.65	(38)

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

(39)m=	117.79	117.6	117.42	116.56	116.4	115.66	115.66	115.52	115.95	116.4	116.73	117.07	

Average = Sum(39)$_{1...12}$ /12= 116.56 (39)

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

(40)m=	1.32	1.32	1.32	1.31	1.31	1.3	1.3	1.3	1.3	1.31	1.31	1.31

Average = Sum(40)$_{1...12}$ /12= 1.31 (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 2.61 (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 96.29 (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=	105.92	102.07	98.22	94.37	90.52	86.66	86.66	90.52	94.37	98.22	102.07	105.92

Total = Sum(44)$_{1...12}$ = 1155.52 (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=	157.08	137.38	141.77	123.6	118.59	102.34	94.83	108.82	110.12	128.33	140.09	152.12

Total = Sum(45)$_{1...12}$ = 1515.07 (45)

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

(46)m=	23.56	20.61	21.27	18.54	17.79	15.35	14.22	16.32	16.52	19.25	21.01	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) = 0 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	50.96	46.03	50.05	46.54	46.13	42.74	44.16	46.13	46.54	50.05	49.32	50.96	(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=	208.04	183.41	191.82	170.13	164.72	145.08	138.99	154.95	156.66	178.39	189.4	203.08	(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=	208.04	183.41	191.82	170.13	164.72	145.08	138.99	154.95	156.66	178.39	189.4	203.08	

Output from water heater (annual)$_{1…12}$ | 2084.67 | (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=	64.97	57.19	59.65	52.73	50.96	44.71	42.57	47.71	48.25	55.18	58.91	63.32	(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=	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	(66)

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

(67)m=	21.18	18.81	15.3	11.58	8.66	7.31	7.9	10.27	13.78	17.5	20.42	21.77	(67)

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

(68)m=	237.58	240.04	233.83	220.61	203.91	188.22	177.74	175.27	181.48	194.71	211.41	227.1	(68)

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

(69)m=	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	(71)

Water heating gains (Table 5)

(72)m=	87.32	85.1	80.18	73.24	68.5	62.1	57.22	64.13	67.01	74.17	81.82	85.11	(72)

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

(73)m=	411.3	409.17	394.52	370.64	346.29	322.85	308.07	314.89	327.49	351.6	378.86	399.19	(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	0.73	x	11.28	x	0.76	x	0.7	=	3.02	(75)
Northeast	0.9x	0.77	x	0.73	x	22.97	x	0.76	x	0.7	=	6.15	(75)
Northeast	0.9x	0.77	x	0.73	x	41.38	x	0.76	x	0.7	=	11.08	(75)
Northeast	0.9x	0.77	x	0.73	x	67.96	x	0.76	x	0.7	=	18.19	(75)
Northeast	0.9x	0.77	x	0.73	x	91.35	x	0.76	x	0.7	=	24.45	(75)
Northeast	0.9x	0.77	x	0.73	x	97.38	x	0.76	x	0.7	=	26.07	(75)
Northeast	0.9x	0.77	x	0.73	x	91.1	x	0.76	x	0.7	=	24.38	(75)
Northeast	0.9x	0.77	x	0.73	x	72.63	x	0.76	x	0.7	=	19.44	(75)
Northeast	0.9x	0.77	x	0.73	x	50.42	x	0.76	x	0.7	=	13.5	(75)
Northeast	0.9x	0.77	x	0.73	x	28.07	x	0.76	x	0.7	=	7.51	(75)
Northeast	0.9x	0.77	x	0.73	x	14.2	x	0.76	x	0.7	=	3.8	(75)
Northeast	0.9x	0.77	x	0.73	x	9.21	x	0.76	x	0.7	=	2.47	(75)
Southeast	0.9x	0.77	x	4.55	x	36.79	x	0.76	x	0.7	=	61.72	(77)
Southeast	0.9x	0.77	x	4.55	x	62.67	x	0.76	x	0.7	=	105.13	(77)
Southeast	0.9x	0.77	x	4.55	x	85.75	x	0.76	x	0.7	=	143.85	(77)
Southeast	0.9x	0.77	x	4.55	x	106.25	x	0.76	x	0.7	=	178.23	(77)
Southeast	0.9x	0.77	x	4.55	x	119.01	x	0.76	x	0.7	=	199.64	(77)
Southeast	0.9x	0.77	x	4.55	x	118.15	x	0.76	x	0.7	=	198.19	(77)
Southeast	0.9x	0.77	x	4.55	x	113.91	x	0.76	x	0.7	=	191.08	(77)
Southeast	0.9x	0.77	x	4.55	x	104.39	x	0.76	x	0.7	=	175.11	(77)
Southeast	0.9x	0.77	x	4.55	x	92.85	x	0.76	x	0.7	=	155.76	(77)
Southeast	0.9x	0.77	x	4.55	x	69.27	x	0.76	x	0.7	=	116.19	(77)
Southeast	0.9x	0.77	x	4.55	x	44.07	x	0.76	x	0.7	=	73.93	(77)
Southeast	0.9x	0.77	x	4.55	x	31.49	x	0.76	x	0.7	=	52.82	(77)
Southwest	0.9x	0.77	x	3.65	x	36.79		0.76	x	0.7	=	49.51	(79)
Southwest	0.9x	0.77	x	3.65	x	62.67		0.76	x	0.7	=	84.34	(79)
Southwest	0.9x	0.77	x	3.65	x	85.75		0.76	x	0.7	=	115.39	(79)
Southwest	0.9x	0.77	x	3.65	x	106.25		0.76	x	0.7	=	142.98	(79)
Southwest	0.9x	0.77	x	3.65	x	119.01		0.76	x	0.7	=	160.15	(79)
Southwest	0.9x	0.77	x	3.65	x	118.15		0.76	x	0.7	=	158.99	(79)
Southwest	0.9x	0.77	x	3.65	x	113.91		0.76	x	0.7	=	153.28	(79)
Southwest	0.9x	0.77	x	3.65	x	104.39		0.76	x	0.7	=	140.47	(79)
Southwest	0.9x	0.77	x	3.65	x	92.85		0.76	x	0.7	=	124.95	(79)
Southwest	0.9x	0.77	x	3.65	x	69.27		0.76	x	0.7	=	93.21	(79)
Southwest	0.9x	0.77	x	3.65	x	44.07		0.76	x	0.7	=	59.3	(79)
Southwest	0.9x	0.77	x	3.65	x	31.49		0.76	x	0.7	=	42.37	(79)
Northwest	0.9x	0.77	x	3.27	x	11.28	x	0.76	x	0.7	=	40.81	(81)
Northwest	0.9x	0.77	x	1.92	x	11.28	x	0.76	x	0.7	=	7.99	(81)
Northwest	0.9x	0.77	x	3.27	x	22.97	x	0.76	x	0.7	=	83.06	(81)

Northwest	0.9x	0.77	x	1.92	x	22.97	x	0.76	x	0.7	=	16.26	(81)
Northwest	0.9x	0.77	x	3.27	x	41.38	x	0.76	x	0.7	=	149.66	(81)
Northwest	0.9x	0.77	x	1.92	x	41.38	x	0.76	x	0.7	=	29.29	(81)
Northwest	0.9x	0.77	x	3.27	x	67.96	x	0.76	x	0.7	=	245.78	(81)
Northwest	0.9x	0.77	x	1.92	x	67.96	x	0.76	x	0.7	=	48.1	(81)
Northwest	0.9x	0.77	x	3.27	x	91.35	x	0.76	x	0.7	=	330.37	(81)
Northwest	0.9x	0.77	x	1.92	x	91.35	x	0.76	x	0.7	=	64.66	(81)
Northwest	0.9x	0.77	x	3.27	x	97.38	x	0.76	x	0.7	=	352.21	(81)
Northwest	0.9x	0.77	x	1.92	x	97.38	x	0.76	x	0.7	=	68.93	(81)
Northwest	0.9x	0.77	x	3.27	x	91.1	x	0.76	x	0.7	=	329.49	(81)
Northwest	0.9x	0.77	x	1.92	x	91.1	x	0.76	x	0.7	=	64.49	(81)
Northwest	0.9x	0.77	x	3.27	x	72.63	x	0.76	x	0.7	=	262.67	(81)
Northwest	0.9x	0.77	x	1.92	x	72.63	x	0.76	x	0.7	=	51.41	(81)
Northwest	0.9x	0.77	x	3.27	x	50.42	x	0.76	x	0.7	=	182.36	(81)
Northwest	0.9x	0.77	x	1.92	x	50.42	x	0.76	x	0.7	=	35.69	(81)
Northwest	0.9x	0.77	x	3.27	x	28.07	x	0.76	x	0.7	=	101.51	(81)
Northwest	0.9x	0.77	x	1.92	x	28.07	x	0.76	x	0.7	=	19.87	(81)
Northwest	0.9x	0.77	x	3.27	x	14.2	x	0.76	x	0.7	=	51.35	(81)
Northwest	0.9x	0.77	x	1.92	x	14.2	x	0.76	x	0.7	=	10.05	(81)
Northwest	0.9x	0.77	x	3.27	x	9.21	x	0.76	x	0.7	=	33.33	(81)
Northwest	0.9x	0.77	x	1.92	x	9.21	x	0.76	x	0.7	=	6.52	(81)
Rooflights	0.9x	1	x	4.29	x	26	x	0.76	x	0.7	=	53.41	(82)
Rooflights	0.9x	1	x	4.29	x	54	x	0.76	x	0.7	=	110.92	(82)
Rooflights	0.9x	1	x	4.29	x	96	x	0.76	x	0.7	=	197.19	(82)
Rooflights	0.9x	1	x	4.29	x	150	x	0.76	x	0.7	=	308.11	(82)
Rooflights	0.9x	1	x	4.29	x	192	x	0.76	x	0.7	=	394.38	(82)
Rooflights	0.9x	1	x	4.29	x	200	x	0.76	x	0.7	=	410.81	(82)
Rooflights	0.9x	1	x	4.29	x	189	x	0.76	x	0.7	=	388.22	(82)
Rooflights	0.9x	1	x	4.29	x	157	x	0.76	x	0.7	=	322.49	(82)
Rooflights	0.9x	1	x	4.29	x	115	x	0.76	x	0.7	=	236.22	(82)
Rooflights	0.9x	1	x	4.29	x	66	x	0.76	x	0.7	=	135.57	(82)
Rooflights	0.9x	1	x	4.29	x	33	x	0.76	x	0.7	=	67.78	(82)
Rooflights	0.9x	1	x	4.29	x	21	x	0.76	x	0.7	=	43.14	(82)

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

(83)m=	216.45	405.86	646.45	941.39	1173.65	1215.21	1150.94	971.59	748.46	473.86	266.21	180.64	(83)

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

(84)m=	627.75	815.03	1040.98	1312.03	1519.93	1538.05	1459.01	1286.48	1075.96	825.46	645.07	579.83	(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

(86)m=	1	0.99	0.95	0.85	0.66	0.47	0.35	0.41	0.68	0.94	0.99	1	(86)

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

(87)m=	19.63	19.89	20.28	20.69	20.92	20.99	21	20.99	20.93	20.55	19.99	19.58	(87)

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

(88)m=	19.82	19.83	19.83	19.84	19.84	19.84	19.84	19.84	19.84	19.84	19.83	19.83	(88)

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

(89)m=	0.99	0.98	0.94	0.81	0.59	0.39	0.26	0.31	0.59	0.91	0.99	1	(89)

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

(90)m=	18.02	18.4	18.95	19.51	19.77	19.84	19.84	19.84	19.8	19.35	18.56	17.96	(90)

fLA = Living area ÷ (4) = 0.34 (91)

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

(92)m=	18.57	18.91	19.4	19.92	20.16	20.23	20.24	20.23	20.18	19.76	19.05	18.51	(92)

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

(93)m=	18.42	18.76	19.25	19.77	20.01	20.08	20.09	20.08	20.03	19.61	18.9	18.36	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.28	0.33	0.61	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	622.88	796.73	970	1055.93	918.36	626.96	402.32	423.85	652.67	744.95	633.92	576.58	(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=	1663.18	1629.41	1497.33	1266.49	967.44	633.47	403.14	425.66	687.82	1048.69	1377.18	1657.46	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	773.98	559.56	392.34	151.61	36.52	0	0	0	0	225.99	535.15	804.18	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3479.3 (98)

Space heating requirement in kWh/m²/year 39.01 (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		90.8	(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)													
	773.98	559.56	392.34	151.61	36.52	0	0	0	0	225.99	535.15	804.18	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	852.4	616.25	432.09	166.97	40.22	0	0	0	0	248.88	589.37	885.66	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3831.83 (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)

208.04	183.41	191.82	170.13	164.72	145.08	138.99	154.95	156.66	178.39	189.4	203.08

Efficiency of water heater 81.5 (216)

(217)m=	88.66	88.31	87.52	85.63	83.04	81.5	81.5	81.5	81.5	86.45	88.17	88.76

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	234.66	207.68	219.17	198.68	198.35	178.01	170.54	190.12	192.22	206.35	214.81	228.81

Total = Sum(219a)$_{1...12}$ = 2439.4 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3831.83	
Water heating fuel used			2439.4	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		30	(231)
Electricity for lighting			374.05	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	827.68	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	526.91	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1354.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	15.57	(267)
Electricity for lighting	(232) x	0.519	=	194.13	(268)
Total CO2, kg/year		sum of (265)…(271) =		1564.29	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		17.54	(273)
EI rating (section 14)				84	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.1.32

Property Address: Flat 4 - Lean

Address : Flat 4, 27 West End Lane, London, NW6 4QJ

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.08	(1a) x	2.35	(2a) =	122.39	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.08	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	122.39	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(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)	0.36	(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) =	0.31	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 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

0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.92	x	1	=	1.92			(26)
Windows Type 1			1	x1/[1/(1.4)+ 0.04]		=	1.33			(27)
Windows Type 2			13.43	x1/[1/(1.4)+ 0.04]		=	17.8			(27)
Floor Type 1			0.69	x	0.13	=	0.0897			(28)
Floor Type 2			12.03	x	0.13	=	1.5639			(28)
Walls Type1	62	14.43	47.57	x	0.17	=	8.09			(29)
Walls Type2	15.75	1.92	13.83	x	0.16	=	2.19			(29)
Total area of elements, m²			90.47							(31)
Party wall			9.1	x	0	=	0			(32)
Party floor			42.99							(32a)
Party ceiling			52.08							(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) = 32.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 12.33 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 45.32 (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	
(38)m=	23.33	23.2	23.09	22.53	22.42	21.93	21.93	21.84	22.12	22.42	22.63	22.85	(38)

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

(39)m=	68.64	68.52	68.4	67.84	67.74	67.25	67.25	67.16	67.44	67.74	67.95	68.17	

Average = Sum(39)$_{1...12}$ /12= 67.84 (39)

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

(40)m=	1.32	1.32	1.31	1.3	1.3	1.29	1.29	1.29	1.29	1.3	1.3	1.31	

Average = Sum(40)$_{1...12}$ /12= 1.3 (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 1.75 (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 75.8 (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=	83.38	80.34	77.31	74.28	71.25	68.22	68.22	71.25	74.28	77.31	80.34	83.38	

Total = Sum(44)$_{1...12}$ = 909.56 (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=	123.64	108.14	111.59	97.29	93.35	80.55	74.64	85.66	86.68	101.02	110.27	119.74	

Total = Sum(45)$_{1...12}$ = 1192.57 (45)

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

(46)m=	18.55	16.22	16.74	14.59	14	12.08	11.2	12.85	13	15.15	16.54	17.96	(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) = 0 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	42.49	36.98	39.4	36.63	36.31	33.64	34.76	36.31	36.63	39.4	39.62	42.49	(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=	166.13	145.12	150.99	133.92	129.66	114.2	109.41	121.96	123.31	140.41	149.89	162.23	(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=	166.13	145.12	150.99	133.92	129.66	114.2	109.41	121.96	123.31	140.41	149.89	162.23

Output from water heater (annual)$_{1...12}$ | 1647.23 | (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=	51.73	45.2	46.95	41.51	40.12	35.19	33.51	37.56	37.98	43.44	46.57	50.44	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	(66)

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

(67)m=	13.61	12.09	9.83	7.44	5.56	4.7	5.07	6.6	8.85	11.24	13.12	13.99	(67)

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

(68)m=	152.63	154.22	150.23	141.73	131	120.92	114.19	112.6	116.6	125.09	135.82	145.9	(68)

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

(69)m=	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	(71)

Water heating gains (Table 5)

(72)m=	69.53	67.26	63.11	57.65	53.92	48.88	45.04	50.48	52.75	58.38	64.68	67.79	(72)

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

(73)m=	288.05	285.84	275.44	259.09	242.76	226.77	216.57	221.95	230.47	246.99	265.89	279.95	(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	x	11.28	x	0.76	x	0.7	=	4.16	(75)
Northeast 0.9x	0.77	x	1	x	22.97	x	0.76	x	0.7	=	8.47	(75)
Northeast 0.9x	0.77	x	1	x	41.38	x	0.76	x	0.7	=	15.26	(75)
Northeast 0.9x	0.77	x	1	x	67.96	x	0.76	x	0.7	=	25.05	(75)
Northeast 0.9x	0.77	x	1	x	91.35	x	0.76	x	0.7	=	33.68	(75)
Northeast 0.9x	0.77	x	1	x	97.38	x	0.76	x	0.7	=	35.9	(75)
Northeast 0.9x	0.77	x	1	x	91.1	x	0.76	x	0.7	=	33.59	(75)
Northeast 0.9x	0.77	x	1	x	72.63	x	0.76	x	0.7	=	26.78	(75)
Northeast 0.9x	0.77	x	1	x	50.42	x	0.76	x	0.7	=	18.59	(75)
Northeast 0.9x	0.77	x	1	x	28.07	x	0.76	x	0.7	=	10.35	(75)
Northeast 0.9x	0.77	x	1	x	14.2	x	0.76	x	0.7	=	5.23	(75)
Northeast 0.9x	0.77	x	1	x	9.21	x	0.76	x	0.7	=	3.4	(75)
Southeast 0.9x	0.77	x	13.43	x	36.79	x	0.76	x	0.7	=	182.18	(77)
Southeast 0.9x	0.77	x	13.43	x	62.67	x	0.76	x	0.7	=	310.32	(77)
Southeast 0.9x	0.77	x	13.43	x	85.75	x	0.76	x	0.7	=	424.59	(77)
Southeast 0.9x	0.77	x	13.43	x	106.25	x	0.76	x	0.7	=	526.09	(77)
Southeast 0.9x	0.77	x	13.43	x	119.01	x	0.76	x	0.7	=	589.26	(77)
Southeast 0.9x	0.77	x	13.43	x	118.15	x	0.76	x	0.7	=	585	(77)
Southeast 0.9x	0.77	x	13.43	x	113.91	x	0.76	x	0.7	=	564	(77)
Southeast 0.9x	0.77	x	13.43	x	104.39	x	0.76	x	0.7	=	516.87	(77)
Southeast 0.9x	0.77	x	13.43	x	92.85	x	0.76	x	0.7	=	459.74	(77)
Southeast 0.9x	0.77	x	13.43	x	69.27	x	0.76	x	0.7	=	342.97	(77)
Southeast 0.9x	0.77	x	13.43	x	44.07	x	0.76	x	0.7	=	218.21	(77)
Southeast 0.9x	0.77	x	13.43	x	31.49	x	0.76	x	0.7	=	155.91	(77)

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

(83)m=	186.34	318.78	439.84	551.14	622.94	620.9	597.59	543.65	478.33	353.31	223.44	159.3	(83)

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

(84)m=	474.38	604.62	715.28	810.23	865.69	847.67	814.16	765.6	708.8	600.3	489.33	439.25	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.83	0.67	0.5	0.36	0.4	0.62	0.88	0.98	0.99	(86)

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

(87)m=	19.82	20.09	20.42	20.73	20.91	20.98	21	20.99	20.95	20.69	20.18	19.76	(87)

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

(88)m=	19.83	19.83	19.83	19.84	19.84	19.85	19.85	19.85	19.84	19.84	19.84	19.83	(88)

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

(89)m=	0.99	0.96	0.9	0.78	0.6	0.41	0.27	0.3	0.53	0.84	0.97	0.99	(89)

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

(90)m=	18.29	18.69	19.15	19.56	19.77	19.84	19.85	19.85	19.82	19.52	18.83	18.21	(90)

fLA = Living area ÷ (4) = 0.59 (91)

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

(92)m=	19.19	19.52	19.89	20.25	20.44	20.51	20.52	20.52	20.48	20.21	19.62	19.12	(92)

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

(93)m=	19.04	19.37	19.74	20.1	20.29	20.36	20.37	20.37	20.33	20.06	19.47	18.97	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.9	0.79	0.63	0.45	0.31	0.35	0.57	0.85	0.96	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	465.99	577.6	644.4	642.19	546.91	381.48	252.81	265.3	403.83	507.69	470.97	433.45	(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=	1011.55	991.21	905.96	759.72	581.95	387.36	253.65	266.68	420.41	640.63	840.65	1006.82	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	405.9	277.95	194.6	84.62	26.07	0	0	0	0	98.91	266.17	426.59	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1780.81 (98)

Space heating requirement in kWh/m²/year 34.19 (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 90.8 (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)													
	405.9	277.95	194.6	84.62	26.07	0	0	0	0	98.91	266.17	426.59	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	447.02	306.11	214.32	93.2	28.71	0	0	0	0	108.93	293.14	469.81	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1961.24 (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)

166.13	145.12	150.99	133.92	129.66	114.2	109.41	121.96	123.31	140.41	149.89	162.23

Efficiency of water heater 81.5 (216)

DER WorkSheet: New dwelling design stage

(217)m=	87.89	87.38	86.49	84.87	82.92	81.5	81.5	81.5	81.5	85.1	87.21	88.03	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	189.03	166.08	174.58	157.8	156.36	140.12	134.24	149.65	151.3	164.99	171.86	184.29

Total = Sum(219a)$_{1...12}$ = 1940.3 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1961.24	
Water heating fuel used			1940.3	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		30	(231)
Electricity for lighting			240.31	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	423.63	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	419.1	(264)
Space and water heating	(261) + (262) + (263) + (264) =				842.73	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	15.57	(267)
Electricity for lighting	(232)	x	0.519	=	124.72	(268)
Total CO2, kg/year			sum of (265)…(271) =		983.02	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		18.88	(273)
EI rating (section 14)					86	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.1.32

Property Address: Flat 5 - Lean

Address : Flat 5, 27 West End Lane, London, NW6 4QJ

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	49.82	(1a)	x	2.35	(2a)	=	117.08	(3a)
First floor	55.95	(1b)	x	2.35	(2b)	=	131.48	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.77	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	248.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.08	(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)	0.28	(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) =	0.24	(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

0.3	0.3	0.29	0.26	0.26	0.23	0.23	0.22	0.24	0.26	0.27	0.28

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.52	0.53	0.53	0.54	0.54	(24d)

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

(25)m=	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.52	0.53	0.53	0.54	0.54	(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			1.92	x 1	=	1.92			(26)
Windows Type 1			5.88	x1/[1/(1.4)+ 0.04]	=	7.8			(27)
Windows Type 2			5.508	x1/[1/(1.4)+ 0.04]	=	7.3			(27)
Windows Type 3			20.08	x1/[1/(1.4)+ 0.04]	=	26.62			(27)
Windows Type 4			8.56	x1/[1/(1.4)+ 0.04]	=	11.35			(27)
Rooflights			11.91	x1/[1/(1.4) + 0.04]	=	16.674			(27b)
Floor Type 1			16.24	x 0.13	=	2.1112			(28)
Floor Type 2			0.22	x 0.13	=	0.0286			(28)
Walls Type1	126.43	40.03	86.4	x 0.17	=	14.69			(29)
Walls Type2	20.49	1.92	18.57	x 0.16	=	2.94			(29)
Roof	80.2	23.82	56.38	x 0.13	=	7.33			(30)
Total area of elements, m²			243.58						(31)
Party wall			5.78	x 0	=	0			(32)
Party floor			62.51						(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) =	113.67	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 22.83 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss — (33) + (36) = 136.5 (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=	44.8	44.65	44.51	43.83	43.71	43.12	43.12	43.01	43.34	43.71	43.96	44.23	(38)

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

(39)m=	181.3	181.15	181.01	180.33	180.2	179.61	179.61	179.5	179.84	180.2	180.46	180.73	

Average = $Sum(39)_{1...12}$ /12= 180.33 (39)

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

(40)m=	1.71	1.71	1.71	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.71	1.71	

Average = $Sum(40)_{1...12}$ /12= 1.7 (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 — 2.79 (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 — 100.39 (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=	110.43	106.41	102.4	98.38	94.37	90.35	90.35	94.37	98.38	102.4	106.41	110.43	

Total = $Sum(44)_{1...12}$ = 1204.67 (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=	163.76	143.23	147.8	128.85	123.64	106.69	98.86	113.45	114.8	133.79	146.04	158.59	

Total = $Sum(45)_{1...12}$ = 1579.51 (45)

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

(46)m=	24.56	21.48	22.17	19.33	18.55	16	14.83	17.02	17.22	20.07	21.91	23.79	(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) = 0 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

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

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

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

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

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

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

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

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

(61)m=	50.96	46.03	50.96	48.52	48.09	44.56	46.04	48.09	48.52	50.96	49.32	50.96	(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=	214.72	189.25	198.76	177.37	171.73	151.25	144.91	161.54	163.32	184.75	195.36	209.55	(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=	214.72	189.25	198.76	177.37	171.73	151.25	144.91	161.54	163.32	184.75	195.36	209.55	

Output from water heater (annual)$_{1…12}$ — 2162.5 (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=	67.19	59.13	61.88	54.97	53.13	46.61	44.38	49.74	50.3	57.23	60.89	65.47	(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=	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	(66)

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

(67)m=	23.65	21.01	17.09	12.94	9.67	8.16	8.82	11.47	15.39	19.54	22.81	24.31	(67)

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

(68)m=	265.33	268.09	261.15	246.38	227.73	210.21	198.5	195.75	202.69	217.46	236.1	253.63	(68)

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

(69)m=	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	(71)

Water heating gains (Table 5)

(72)m=	90.31	87.99	83.18	76.35	71.41	64.74	59.65	66.86	69.86	76.92	84.57	88	(72)

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

(73)m=	447.1	444.89	429.21	403.47	376.62	350.92	334.78	341.88	355.74	381.72	411.28	433.74	(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	5.88	11.28	0.76	0.7	24.46	(75)
Northeast 0.9x	0.77	5.88	22.97	0.76	0.7	49.79	(75)
Northeast 0.9x	0.77	5.88	41.38	0.76	0.7	89.7	(75)
Northeast 0.9x	0.77	5.88	67.96	0.76	0.7	147.32	(75)
Northeast 0.9x	0.77	5.88	91.35	0.76	0.7	198.02	(75)
Northeast 0.9x	0.77	5.88	97.38	0.76	0.7	211.11	(75)
Northeast 0.9x	0.77	5.88	91.1	0.76	0.7	197.49	(75)
Northeast 0.9x	0.77	5.88	72.63	0.76	0.7	157.44	(75)
Northeast 0.9x	0.77	5.88	50.42	0.76	0.7	109.3	(75)
Northeast 0.9x	0.77	5.88	28.07	0.76	0.7	60.84	(75)
Northeast 0.9x	0.77	5.88	14.2	0.76	0.7	30.78	(75)
Northeast 0.9x	0.77	5.88	9.21	0.76	0.7	19.97	(75)
Southeast 0.9x	0.77	5.51	36.79	0.76	0.7	74.72	(77)
Southeast 0.9x	0.77	5.51	62.67	0.76	0.7	127.27	(77)
Southeast 0.9x	0.77	5.51	85.75	0.76	0.7	174.14	(77)
Southeast 0.9x	0.77	5.51	106.25	0.76	0.7	215.76	(77)
Southeast 0.9x	0.77	5.51	119.01	0.76	0.7	241.67	(77)
Southeast 0.9x	0.77	5.51	118.15	0.76	0.7	239.92	(77)
Southeast 0.9x	0.77	5.51	113.91	0.76	0.7	231.31	(77)
Southeast 0.9x	0.77	5.51	104.39	0.76	0.7	211.98	(77)
Southeast 0.9x	0.77	5.51	92.85	0.76	0.7	188.55	(77)
Southeast 0.9x	0.77	5.51	69.27	0.76	0.7	140.66	(77)
Southeast 0.9x	0.77	5.51	44.07	0.76	0.7	89.49	(77)
Southeast 0.9x	0.77	5.51	31.49	0.76	0.7	63.94	(77)
Southwest 0.9x	0.77	8.56	36.79	0.76	0.7	116.12	(79)
Southwest 0.9x	0.77	8.56	62.67	0.76	0.7	197.79	(79)
Southwest 0.9x	0.77	8.56	85.75	0.76	0.7	270.62	(79)
Southwest 0.9x	0.77	8.56	106.25	0.76	0.7	335.32	(79)
Southwest 0.9x	0.77	8.56	119.01	0.76	0.7	375.58	(79)
Southwest 0.9x	0.77	8.56	118.15	0.76	0.7	372.87	(79)
Southwest 0.9x	0.77	8.56	113.91	0.76	0.7	359.48	(79)
Southwest 0.9x	0.77	8.56	104.39	0.76	0.7	329.44	(79)
Southwest 0.9x	0.77	8.56	92.85	0.76	0.7	293.03	(79)
Southwest 0.9x	0.77	8.56	69.27	0.76	0.7	218.6	(79)
Southwest 0.9x	0.77	8.56	44.07	0.76	0.7	139.08	(79)
Southwest 0.9x	0.77	8.56	31.49	0.76	0.7	99.37	(79)
Northwest 0.9x	0.77	20.08	11.28	0.76	0.7	83.53	(81)
Northwest 0.9x	0.77	20.08	22.97	0.76	0.7	170.02	(81)
Northwest 0.9x	0.77	20.08	41.38	0.76	0.7	306.33	(81)

Northwest	0.9x	0.77	x	20.08	x	67.96	x	0.76	x	0.7	=	503.08	(81)
Northwest	0.9x	0.77	x	20.08	x	91.35	x	0.76	x	0.7	=	676.24	(81)
Northwest	0.9x	0.77	x	20.08	x	97.38	x	0.76	x	0.7	=	720.94	(81)
Northwest	0.9x	0.77	x	20.08	x	91.1	x	0.76	x	0.7	=	674.42	(81)
Northwest	0.9x	0.77	x	20.08	x	72.63	x	0.76	x	0.7	=	537.66	(81)
Northwest	0.9x	0.77	x	20.08	x	50.42	x	0.76	x	0.7	=	373.26	(81)
Northwest	0.9x	0.77	x	20.08	x	28.07	x	0.76	x	0.7	=	207.78	(81)
Northwest	0.9x	0.77	x	20.08	x	14.2	x	0.76	x	0.7	=	105.1	(81)
Northwest	0.9x	0.77	x	20.08	x	9.21	x	0.76	x	0.7	=	68.21	(81)
Rooflights	0.9x	1	x	11.91	x	26	x	0.76	x	0.7	=	296.53	(82)
Rooflights	0.9x	1	x	11.91	x	54	x	0.76	x	0.7	=	615.87	(82)
Rooflights	0.9x	1	x	11.91	x	96	x	0.76	x	0.7	=	1094.88	(82)
Rooflights	0.9x	1	x	11.91	x	150	x	0.76	x	0.7	=	1710.75	(82)
Rooflights	0.9x	1	x	11.91	x	192	x	0.76	x	0.7	=	2189.76	(82)
Rooflights	0.9x	1	x	11.91	x	200	x	0.76	x	0.7	=	2281	(82)
Rooflights	0.9x	1	x	11.91	x	189	x	0.76	x	0.7	=	2155.55	(82)
Rooflights	0.9x	1	x	11.91	x	157	x	0.76	x	0.7	=	1790.59	(82)
Rooflights	0.9x	1	x	11.91	x	115	x	0.76	x	0.7	=	1311.58	(82)
Rooflights	0.9x	1	x	11.91	x	66	x	0.76	x	0.7	=	752.73	(82)
Rooflights	0.9x	1	x	11.91	x	33	x	0.76	x	0.7	=	376.37	(82)
Rooflights	0.9x	1	x	11.91	x	21	x	0.76	x	0.7	=	239.51	(82)

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

(83)m=	595.35	1160.74	1935.67	2912.22	3681.27	3825.84	3618.26	3027.11	2275.72	1380.62	740.81	491.01	(83)

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

(84)m=	1042.45	1605.63	2364.88	3315.69	4057.89	4176.76	3953.03	3368.99	2631.46	1762.33	1152.09	924.75	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.95	0.83	0.6	0.4	0.27	0.2	0.24	0.46	0.81	0.97	0.99	(86)

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

(87)m=	19.39	19.88	20.46	20.85	20.97	20.99	21	21	20.97	20.64	19.88	19.29	(87)

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

(88)m=	19.53	19.53	19.53	19.54	19.54	19.54	19.54	19.54	19.54	19.54	19.54	19.53	(88)

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

(89)m=	0.98	0.93	0.79	0.54	0.34	0.21	0.13	0.17	0.37	0.75	0.96	0.99	(89)

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

(90)m=	17.48	18.17	18.94	19.4	19.52	19.54	19.54	19.54	19.52	19.2	18.19	17.34	(90)

fLA = Living area ÷ (4) = | 0.43 | (91)

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

(92)m=	18.3	18.9	19.59	20.02	20.14	20.16	20.17	20.17	20.14	19.82	18.91	18.18	(92)

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

(93)m=	18.15	18.75	19.44	19.87	19.99	20.01	20.02	20.02	19.99	19.67	18.76	18.03	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.92	0.78	0.56	0.36	0.23	0.16	0.19	0.39	0.76	0.95	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1018.52	1479.52	1853.6	1850.45	1470.68	969.11	613.22	648.04	1037.9	1334.61	1093.01	910.03	(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=	2511.2	2509.34	2343.02	1978.98	1493.88	972.38	613.72	649.17	1059.61	1634.12	2104.74	2499.24	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1110.56	692.04	364.13	92.54	17.26	0	0	0	0	222.84	728.45	1182.37	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4410.19 (98)

Space heating requirement in kWh/m²/year 41.7 (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		90.8	(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)														
	1110.56	692.04	364.13	92.54	17.26	0	0	0	0	222.84	728.45	1182.37		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	1223.08	762.16	401.02	101.92	19.01	0	0	0	0	245.42	802.26	1302.17		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													4857.04	(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)

Water heating

Output from water heater (calculated above)														
	214.72	189.25	198.76	177.37	171.73	151.25	144.91	161.54	163.32	184.75	195.36	209.55		
Efficiency of water heater													81.5	(216)
(217)m=	89.15	88.63	87.28	84.47	82.27	81.5	81.5	81.5	81.5	86.33	88.66	89.27		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	240.85	213.54	227.71	209.99	208.73	185.58	177.8	198.2	200.39	213.99	220.34	234.75		
Total = Sum(219a)$_{1...12}$ =													2531.88	(219)

DER WorkSheet: New dwelling design stage

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			4857.04	
Water heating fuel used			2531.88	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		30	(231)
Electricity for lighting			417.75	(232)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	1049.12	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	546.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1596.01	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	15.57	(267)
Electricity for lighting	(232)	x	0.519	=	216.81	(268)
Total CO2, kg/year			sum of (265)…(271) =		1828.39	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		17.29	(273)
EI rating (section 14)					84	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.1.32

Property Address: Flat 1 - Green

Address : Flat 1, 27 West End Lane, London, NW6 4QJ

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	89.19	(1a) x	2.35	(2a) =	209.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	89.19	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	209.6	(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							3	x 10 =	30	(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) =	30	÷ (5) =	0.14	(8)

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

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)	0.34	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.29	(21)

Infiltration rate modified for monthly wind speed

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

0.37	0.36	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

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

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			1.92	x	1	=	1.92			(26)
Windows Type 1			3.27		x1/[1/(1.4)+ 0.04]	=	4.34			(27)
Windows Type 2			1.92		x1/[1/(1.4)+ 0.04]	=	2.55			(27)
Windows Type 3			3.65		x1/[1/(1.4)+ 0.04]	=	4.84			(27)
Windows Type 4			0.726		x1/[1/(1.4)+ 0.04]	=	0.96			(27)
Windows Type 5			4.55		x1/[1/(1.4)+ 0.04]	=	6.03			(27)
Rooflights			4.29		x1/[1/(1.4) + 0.04]	=	6.006			(27b)
Floor			89.19	x	0.13	=	11.5947			(28)
Walls Type1	82.48	20.66	61.82	x	0.17	=	10.51			(29)
Walls Type2	42.3	1.92	40.38	x	0.16	=	6.4			(29)
Roof	23.03	4.29	18.74	x	0.13	=	2.44			(30)
Total area of elements, m²			237							(31)
Party ceiling			66.16							(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) =	65.93	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K	12.49	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 78.42 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.37	39.18	39	38.14	37.98	37.24	37.24	37.1	37.53	37.98	38.31	38.65	(38)

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

(39)m=	117.79	117.6	117.42	116.56	116.4	115.66	115.66	115.52	115.95	116.4	116.73	117.07	

Average = Sum(39)$_{1…12}$ /12= 116.56 (39)

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

(40)m=	1.32	1.32	1.32	1.31	1.31	1.3	1.3	1.3	1.3	1.31	1.31	1.31

Average = Sum(40)$_{1…12}$ /12= 1.31 (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 2.61 (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 96.29 (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=	105.92	102.07	98.22	94.37	90.52	86.66	86.66	90.52	94.37	98.22	102.07	105.92

Total = Sum(44)$_{1…12}$ = 1155.52 (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=	157.08	137.38	141.77	123.6	118.59	102.34	94.83	108.82	110.12	128.33	140.09	152.12

Total = Sum(45)$_{1…12}$ = 1515.07 (45)

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

(46)m=	23.56	20.61	21.27	18.54	17.79	15.35	14.22	16.32	16.52	19.25	21.01	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) = 0 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	50.96	46.03	50.05	46.54	46.13	42.74	44.16	46.13	46.54	50.05	49.32	50.96	(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=	208.04	183.41	191.82	170.13	164.72	145.08	138.99	154.95	156.66	178.39	189.4	203.08	(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=	208.04	183.41	191.82	170.13	164.72	145.08	138.99	154.95	156.66	178.39	189.4	203.08	

Output from water heater (annual)$_{1...12}$ 2084.67 (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=	64.97	57.19	59.65	52.73	50.96	44.71	42.57	47.71	48.25	55.18	58.91	63.32	(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=	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	130.72	(66)

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

(67)m=	21.18	18.81	15.3	11.58	8.66	7.31	7.9	10.27	13.78	17.5	20.42	21.77	(67)

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

(68)m=	237.58	240.04	233.83	220.61	203.91	188.22	177.74	175.27	181.48	194.71	211.41	227.1	(68)

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

(69)m=	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	-104.58	(71)

Water heating gains (Table 5)

(72)m=	87.32	85.1	80.18	73.24	68.5	62.1	57.22	64.13	67.01	74.17	81.82	85.11	(72)

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

(73)m=	411.3	409.17	394.52	370.64	346.29	322.85	308.07	314.89	327.49	351.6	378.86	399.19	(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	0.73	x	11.28	x	0.76	x	0.7	=	3.02	(75)
Northeast	0.9x	0.77	x	0.73	x	22.97	x	0.76	x	0.7	=	6.15	(75)
Northeast	0.9x	0.77	x	0.73	x	41.38	x	0.76	x	0.7	=	11.08	(75)
Northeast	0.9x	0.77	x	0.73	x	67.96	x	0.76	x	0.7	=	18.19	(75)
Northeast	0.9x	0.77	x	0.73	x	91.35	x	0.76	x	0.7	=	24.45	(75)
Northeast	0.9x	0.77	x	0.73	x	97.38	x	0.76	x	0.7	=	26.07	(75)
Northeast	0.9x	0.77	x	0.73	x	91.1	x	0.76	x	0.7	=	24.38	(75)
Northeast	0.9x	0.77	x	0.73	x	72.63	x	0.76	x	0.7	=	19.44	(75)
Northeast	0.9x	0.77	x	0.73	x	50.42	x	0.76	x	0.7	=	13.5	(75)
Northeast	0.9x	0.77	x	0.73	x	28.07	x	0.76	x	0.7	=	7.51	(75)
Northeast	0.9x	0.77	x	0.73	x	14.2	x	0.76	x	0.7	=	3.8	(75)
Northeast	0.9x	0.77	x	0.73	x	9.21	x	0.76	x	0.7	=	2.47	(75)
Southeast	0.9x	0.77	x	4.55	x	36.79	x	0.76	x	0.7	=	61.72	(77)
Southeast	0.9x	0.77	x	4.55	x	62.67	x	0.76	x	0.7	=	105.13	(77)
Southeast	0.9x	0.77	x	4.55	x	85.75	x	0.76	x	0.7	=	143.85	(77)
Southeast	0.9x	0.77	x	4.55	x	106.25	x	0.76	x	0.7	=	178.23	(77)
Southeast	0.9x	0.77	x	4.55	x	119.01	x	0.76	x	0.7	=	199.64	(77)
Southeast	0.9x	0.77	x	4.55	x	118.15	x	0.76	x	0.7	=	198.19	(77)
Southeast	0.9x	0.77	x	4.55	x	113.91	x	0.76	x	0.7	=	191.08	(77)
Southeast	0.9x	0.77	x	4.55	x	104.39	x	0.76	x	0.7	=	175.11	(77)
Southeast	0.9x	0.77	x	4.55	x	92.85	x	0.76	x	0.7	=	155.76	(77)
Southeast	0.9x	0.77	x	4.55	x	69.27	x	0.76	x	0.7	=	116.19	(77)
Southeast	0.9x	0.77	x	4.55	x	44.07	x	0.76	x	0.7	=	73.93	(77)
Southeast	0.9x	0.77	x	4.55	x	31.49	x	0.76	x	0.7	=	52.82	(77)
Southwest	0.9x	0.77	x	3.65	x	36.79		0.76	x	0.7	=	49.51	(79)
Southwest	0.9x	0.77	x	3.65	x	62.67		0.76	x	0.7	=	84.34	(79)
Southwest	0.9x	0.77	x	3.65	x	85.75		0.76	x	0.7	=	115.39	(79)
Southwest	0.9x	0.77	x	3.65	x	106.25		0.76	x	0.7	=	142.98	(79)
Southwest	0.9x	0.77	x	3.65	x	119.01		0.76	x	0.7	=	160.15	(79)
Southwest	0.9x	0.77	x	3.65	x	118.15		0.76	x	0.7	=	158.99	(79)
Southwest	0.9x	0.77	x	3.65	x	113.91		0.76	x	0.7	=	153.28	(79)
Southwest	0.9x	0.77	x	3.65	x	104.39		0.76	x	0.7	=	140.47	(79)
Southwest	0.9x	0.77	x	3.65	x	92.85		0.76	x	0.7	=	124.95	(79)
Southwest	0.9x	0.77	x	3.65	x	69.27		0.76	x	0.7	=	93.21	(79)
Southwest	0.9x	0.77	x	3.65	x	44.07		0.76	x	0.7	=	59.3	(79)
Southwest	0.9x	0.77	x	3.65	x	31.49		0.76	x	0.7	=	42.37	(79)
Northwest	0.9x	0.77	x	3.27	x	11.28	x	0.76	x	0.7	=	40.81	(81)
Northwest	0.9x	0.77	x	1.92	x	11.28	x	0.76	x	0.7	=	7.99	(81)
Northwest	0.9x	0.77	x	3.27	x	22.97	x	0.76	x	0.7	=	83.06	(81)

Northwest 0.9x	0.77	x	1.92	x	22.97	x	0.76	x	0.7	=	16.26	(81)
Northwest 0.9x	0.77	x	3.27	x	41.38	x	0.76	x	0.7	=	149.66	(81)
Northwest 0.9x	0.77	x	1.92	x	41.38	x	0.76	x	0.7	=	29.29	(81)
Northwest 0.9x	0.77	x	3.27	x	67.96	x	0.76	x	0.7	=	245.78	(81)
Northwest 0.9x	0.77	x	1.92	x	67.96	x	0.76	x	0.7	=	48.1	(81)
Northwest 0.9x	0.77	x	3.27	x	91.35	x	0.76	x	0.7	=	330.37	(81)
Northwest 0.9x	0.77	x	1.92	x	91.35	x	0.76	x	0.7	=	64.66	(81)
Northwest 0.9x	0.77	x	3.27	x	97.38	x	0.76	x	0.7	=	352.21	(81)
Northwest 0.9x	0.77	x	1.92	x	97.38	x	0.76	x	0.7	=	68.93	(81)
Northwest 0.9x	0.77	x	3.27	x	91.1	x	0.76	x	0.7	=	329.49	(81)
Northwest 0.9x	0.77	x	1.92	x	91.1	x	0.76	x	0.7	=	64.49	(81)
Northwest 0.9x	0.77	x	3.27	x	72.63	x	0.76	x	0.7	=	262.67	(81)
Northwest 0.9x	0.77	x	1.92	x	72.63	x	0.76	x	0.7	=	51.41	(81)
Northwest 0.9x	0.77	x	3.27	x	50.42	x	0.76	x	0.7	=	182.36	(81)
Northwest 0.9x	0.77	x	1.92	x	50.42	x	0.76	x	0.7	=	35.69	(81)
Northwest 0.9x	0.77	x	3.27	x	28.07	x	0.76	x	0.7	=	101.51	(81)
Northwest 0.9x	0.77	x	1.92	x	28.07	x	0.76	x	0.7	=	19.87	(81)
Northwest 0.9x	0.77	x	3.27	x	14.2	x	0.76	x	0.7	=	51.35	(81)
Northwest 0.9x	0.77	x	1.92	x	14.2	x	0.76	x	0.7	=	10.05	(81)
Northwest 0.9x	0.77	x	3.27	x	9.21	x	0.76	x	0.7	=	33.33	(81)
Northwest 0.9x	0.77	x	1.92	x	9.21	x	0.76	x	0.7	=	6.52	(81)
Rooflights 0.9x	1	x	4.29	x	26	x	0.76	x	0.7	=	53.41	(82)
Rooflights 0.9x	1	x	4.29	x	54	x	0.76	x	0.7	=	110.92	(82)
Rooflights 0.9x	1	x	4.29	x	96	x	0.76	x	0.7	=	197.19	(82)
Rooflights 0.9x	1	x	4.29	x	150	x	0.76	x	0.7	=	308.11	(82)
Rooflights 0.9x	1	x	4.29	x	192	x	0.76	x	0.7	=	394.38	(82)
Rooflights 0.9x	1	x	4.29	x	200	x	0.76	x	0.7	=	410.81	(82)
Rooflights 0.9x	1	x	4.29	x	189	x	0.76	x	0.7	=	388.22	(82)
Rooflights 0.9x	1	x	4.29	x	157	x	0.76	x	0.7	=	322.49	(82)
Rooflights 0.9x	1	x	4.29	x	115	x	0.76	x	0.7	=	236.22	(82)
Rooflights 0.9x	1	x	4.29	x	66	x	0.76	x	0.7	=	135.57	(82)
Rooflights 0.9x	1	x	4.29	x	33	x	0.76	x	0.7	=	67.78	(82)
Rooflights 0.9x	1	x	4.29	x	21	x	0.76	x	0.7	=	43.14	(82)

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

(83)m=	216.45	405.86	646.45	941.39	1173.65	1215.21	1150.94	971.59	748.46	473.86	266.21	180.64	(83)

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

(84)m=	627.75	815.03	1040.98	1312.03	1519.93	1538.05	1459.01	1286.48	1075.96	825.46	645.07	579.83	(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

(86)m=	1	0.99	0.95	0.85	0.66	0.47	0.35	0.41	0.68	0.94	0.99	1	(86)

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

(87)m=	19.63	19.89	20.28	20.69	20.92	20.99	21	20.99	20.93	20.55	19.99	19.58	(87)

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

(88)m=	19.82	19.83	19.83	19.84	19.84	19.84	19.84	19.84	19.84	19.84	19.83	19.83	(88)

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

(89)m=	0.99	0.98	0.94	0.81	0.59	0.39	0.26	0.31	0.59	0.91	0.99	1	(89)

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

(90)m=	18.02	18.4	18.95	19.51	19.77	19.84	19.84	19.84	19.8	19.35	18.56	17.96	(90)

fLA = Living area ÷ (4) = 0.34 (91)

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

(92)m=	18.57	18.91	19.4	19.92	20.16	20.23	20.24	20.23	20.18	19.76	19.05	18.51	(92)

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

(93)m=	18.42	18.76	19.25	19.77	20.01	20.08	20.09	20.08	20.03	19.61	18.9	18.36	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.28	0.33	0.61	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	622.88	796.73	970	1055.93	918.36	626.96	402.32	423.85	652.67	744.95	633.92	576.58	(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=	1663.18	1629.41	1497.33	1266.49	967.44	633.47	403.14	425.66	687.82	1048.69	1377.18	1657.46	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	773.98	559.56	392.34	151.61	36.52	0	0	0	0	225.99	535.15	804.18	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3479.3 (98)

Space heating requirement in kWh/m²/year 39.01 (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		90.8	(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)													
	773.98	559.56	392.34	151.61	36.52	0	0	0	0	225.99	535.15	804.18	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	852.4	616.25	432.09	166.97	40.22	0	0	0	0	248.88	589.37	885.66	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3831.83 (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)

208.04	183.41	191.82	170.13	164.72	145.08	138.99	154.95	156.66	178.39	189.4	203.08

Efficiency of water heater 81.5 (216)

(217)m=	88.66	88.31	87.52	85.63	83.04	81.5	81.5	81.5	81.5	86.45	88.17	88.76	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	234.66	207.68	219.17	198.68	198.35	178.01	170.54	190.12	192.22	206.35	214.81	228.81

Total = Sum(219a)$_{1...12}$ = 2439.4 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3831.83	
Water heating fuel used		2439.4	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		30	(231)
Electricity for lighting		374.05	(232)
Electricity generated by PVs		-855.55	(233)

12a. CO_2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	827.68	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	526.91	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1354.59	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	15.57	(267)
Electricity for lighting	(232)	x	0.519	=	194.13	(268)
Energy saving/generation technologies Item 1			0.519	=	-444.03	(269)
Total CO2, kg/year			sum of (265)…(271) =		1120.26	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		12.56	(273)
EI rating (section 14)					89	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.1.32

Property Address: Flat 4 - Green

Address : Flat 4, 27 West End Lane, London, NW6 4QJ

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.08	(1a) x	2.35	(2a) =	122.39	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.08	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	122.39	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(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)	0.36	(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) =	0.31	(21)

Infiltration rate modified for monthly wind speed

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

0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.92	x	1	=	1.92			(26)
Windows Type 1			1	x1/[1/(1.4)+ 0.04]		=	1.33			(27)
Windows Type 2			13.43	x1/[1/(1.4)+ 0.04]		=	17.8			(27)
Floor Type 1			0.69	x	0.13	=	0.0897			(28)
Floor Type 2			12.03	x	0.13	=	1.5639			(28)
Walls Type1	62	14.43	47.57	x	0.17	=	8.09			(29)
Walls Type2	15.75	1.92	13.83	x	0.16	=	2.19			(29)
Total area of elements, m²			90.47							(31)
Party wall			9.1	x	0	=	0			(32)
Party floor			42.99							(32a)
Party ceiling			52.08							(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) = 32.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 12.33 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 45.32 (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	
(38)m=	23.33	23.2	23.09	22.53	22.42	21.93	21.93	21.84	22.12	22.42	22.63	22.85	(38)

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

(39)m=	68.64	68.52	68.4	67.84	67.74	67.25	67.25	67.16	67.44	67.74	67.95	68.17	

Average = Sum(39)$_{1...12}$ /12= 67.84 (39)

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

(40)m=	1.32	1.32	1.31	1.3	1.3	1.29	1.29	1.29	1.29	1.3	1.3	1.31	

Average = Sum(40)$_{1...12}$ /12= 1.3 (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 1.75 (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 75.8 (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=	83.38	80.34	77.31	74.28	71.25	68.22	68.22	71.25	74.28	77.31	80.34	83.38	

Total = Sum(44)$_{1...12}$ = 909.56 (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=	123.64	108.14	111.59	97.29	93.35	80.55	74.64	85.66	86.68	101.02	110.27	119.74	

Total = Sum(45)$_{1...12}$ = 1192.57 (45)

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

(46)m=	18.55	16.22	16.74	14.59	14	12.08	11.2	12.85	13	15.15	16.54	17.96	(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) = 0 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	42.49	36.98	39.4	36.63	36.31	33.64	34.76	36.31	36.63	39.4	39.62	42.49	(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=	166.13	145.12	150.99	133.92	129.66	114.2	109.41	121.96	123.31	140.41	149.89	162.23	(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=	166.13	145.12	150.99	133.92	129.66	114.2	109.41	121.96	123.31	140.41	149.89	162.23

Output from water heater (annual)$_{1...12}$ | 1647.23 | (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=	51.73	45.2	46.95	41.51	40.12	35.19	33.51	37.56	37.98	43.44	46.57	50.44	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	87.57	(66)

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

(67)m=	13.61	12.09	9.83	7.44	5.56	4.7	5.07	6.6	8.85	11.24	13.12	13.99	(67)

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

(68)m=	152.63	154.22	150.23	141.73	131	120.92	114.19	112.6	116.6	125.09	135.82	145.9	(68)

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

(69)m=	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	-70.06	(71)

Water heating gains (Table 5)

(72)m=	69.53	67.26	63.11	57.65	53.92	48.88	45.04	50.48	52.75	58.38	64.68	67.79	(72)

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

(73)m=	288.05	285.84	275.44	259.09	242.76	226.77	216.57	221.95	230.47	246.99	265.89	279.95	(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	x	11.28	x	0.76	x	0.7	=	4.16	(75)
Northeast 0.9x	0.77	x	1	x	22.97	x	0.76	x	0.7	=	8.47	(75)
Northeast 0.9x	0.77	x	1	x	41.38	x	0.76	x	0.7	=	15.26	(75)
Northeast 0.9x	0.77	x	1	x	67.96	x	0.76	x	0.7	=	25.05	(75)
Northeast 0.9x	0.77	x	1	x	91.35	x	0.76	x	0.7	=	33.68	(75)
Northeast 0.9x	0.77	x	1	x	97.38	x	0.76	x	0.7	=	35.9	(75)
Northeast 0.9x	0.77	x	1	x	91.1	x	0.76	x	0.7	=	33.59	(75)
Northeast 0.9x	0.77	x	1	x	72.63	x	0.76	x	0.7	=	26.78	(75)
Northeast 0.9x	0.77	x	1	x	50.42	x	0.76	x	0.7	=	18.59	(75)
Northeast 0.9x	0.77	x	1	x	28.07	x	0.76	x	0.7	=	10.35	(75)
Northeast 0.9x	0.77	x	1	x	14.2	x	0.76	x	0.7	=	5.23	(75)
Northeast 0.9x	0.77	x	1	x	9.21	x	0.76	x	0.7	=	3.4	(75)
Southeast 0.9x	0.77	x	13.43	x	36.79	x	0.76	x	0.7	=	182.18	(77)
Southeast 0.9x	0.77	x	13.43	x	62.67	x	0.76	x	0.7	=	310.32	(77)
Southeast 0.9x	0.77	x	13.43	x	85.75	x	0.76	x	0.7	=	424.59	(77)
Southeast 0.9x	0.77	x	13.43	x	106.25	x	0.76	x	0.7	=	526.09	(77)
Southeast 0.9x	0.77	x	13.43	x	119.01	x	0.76	x	0.7	=	589.26	(77)
Southeast 0.9x	0.77	x	13.43	x	118.15	x	0.76	x	0.7	=	585	(77)
Southeast 0.9x	0.77	x	13.43	x	113.91	x	0.76	x	0.7	=	564	(77)
Southeast 0.9x	0.77	x	13.43	x	104.39	x	0.76	x	0.7	=	516.87	(77)
Southeast 0.9x	0.77	x	13.43	x	92.85	x	0.76	x	0.7	=	459.74	(77)
Southeast 0.9x	0.77	x	13.43	x	69.27	x	0.76	x	0.7	=	342.97	(77)
Southeast 0.9x	0.77	x	13.43	x	44.07	x	0.76	x	0.7	=	218.21	(77)
Southeast 0.9x	0.77	x	13.43	x	31.49	x	0.76	x	0.7	=	155.91	(77)

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

(83)m=	186.34	318.78	439.84	551.14	622.94	620.9	597.59	543.65	478.33	353.31	223.44	159.3	(83)

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

(84)m=	474.38	604.62	715.28	810.23	865.69	847.67	814.16	765.6	708.8	600.3	489.33	439.25	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.83	0.67	0.5	0.36	0.4	0.62	0.88	0.98	0.99	(86)

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

(87)m=	19.82	20.09	20.42	20.73	20.91	20.98	21	20.99	20.95	20.69	20.18	19.76	(87)

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

(88)m=	19.83	19.83	19.83	19.84	19.84	19.85	19.85	19.85	19.84	19.84	19.84	19.83	(88)

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

(89)m=	0.99	0.96	0.9	0.78	0.6	0.41	0.27	0.3	0.53	0.84	0.97	0.99	(89)

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

(90)m=	18.29	18.69	19.15	19.56	19.77	19.84	19.85	19.85	19.82	19.52	18.83	18.21	(90)

fLA = Living area ÷ (4) = 0.59 (91)

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

(92)m=	19.19	19.52	19.89	20.25	20.44	20.51	20.52	20.52	20.48	20.21	19.62	19.12	(92)

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

(93)m=	19.04	19.37	19.74	20.1	20.29	20.36	20.37	20.37	20.33	20.06	19.47	18.97	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.9	0.79	0.63	0.45	0.31	0.35	0.57	0.85	0.96	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	465.99	577.6	644.4	642.19	546.91	381.48	252.81	265.3	403.83	507.69	470.97	433.45	(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=	1011.55	991.21	905.96	759.72	581.95	387.36	253.65	266.68	420.41	640.63	840.65	1006.82	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	405.9	277.95	194.6	84.62	26.07	0	0	0	0	98.91	266.17	426.59	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1780.81 (98)

Space heating requirement in kWh/m²/year 34.19 (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 90.8 (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)													
	405.9	277.95	194.6	84.62	26.07	0	0	0	0	98.91	266.17	426.59	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	447.02	306.11	214.32	93.2	28.71	0	0	0	0	108.93	293.14	469.81	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1961.24 (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)

166.13	145.12	150.99	133.92	129.66	114.2	109.41	121.96	123.31	140.41	149.89	162.23

Efficiency of water heater 81.5 (216)

(217)m=	87.89	87.38	86.49	84.87	82.92	81.5	81.5	81.5	81.5	85.1	87.21	88.03	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	189.03	166.08	174.58	157.8	156.36	140.12	134.24	149.65	151.3	164.99	171.86	184.29

Total = $Sum(219a)_{1...12}$ = 1940.3 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1961.24	
Water heating fuel used			1940.3	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		30	(231)
Electricity for lighting			240.31	(232)
Electricity generated by PVs			-855.55	(233)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	423.63	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	419.1	(264)
Space and water heating	(261) + (262) + (263) + (264) =				842.73	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	15.57	(267)
Electricity for lighting	(232)	x	0.519	=	124.72	(268)
Energy saving/generation technologies						
Item 1			0.519	=	-444.03	(269)
Total CO2, kg/year			sum of (265)…(271) =		538.99	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		10.35	(273)
EI rating (section 14)					93	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.1.32

Property Address: Flat 5 - Green

Address : Flat 5, 27 West End Lane, London, NW6 4QJ

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	49.82	(1a)	x	2.35	(2a)	=	117.08	(3a)
First floor	55.95	(1b)	x	2.35	(2b)	=	131.48	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.77	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	248.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.08	(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)	0.28	(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) =	0.24	(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

0.3	0.3	0.29	0.26	0.26	0.23	0.23	0.22	0.24	0.26	0.27	0.28

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.52	0.53	0.53	0.54	0.54	(24d)

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

(25)m=	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.52	0.53	0.53	0.54	0.54	(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			1.92	x	1	=	1.92			(26)
Windows Type 1			5.88		x1/[1/(1.4)+ 0.04]	=	7.8			(27)
Windows Type 2			5.508		x1/[1/(1.4)+ 0.04]	=	7.3			(27)
Windows Type 3			20.08		x1/[1/(1.4)+ 0.04]	=	26.62			(27)
Windows Type 4			8.56		x1/[1/(1.4)+ 0.04]	=	11.35			(27)
Rooflights			11.91		x1/[1/(1.4) + 0.04]	=	16.674			(27b)
Floor Type 1			16.24	x	0.13	=	2.1112			(28)
Floor Type 2			0.22	x	0.13	=	0.0286			(28)
Walls Type1	126.43	40.03	86.4	x	0.17	=	14.69			(29)
Walls Type2	20.49	1.92	18.57	x	0.16	=	2.94			(29)
Roof	80.2	23.82	56.38	x	0.13	=	7.33			(30)
Total area of elements, m²			243.58							(31)
Party wall			5.78	x	0	=	0			(32)
Party floor			62.51							(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) = 113.67 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 22.83 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss — (33) + (36) = — 136.5 (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=	44.8	44.65	44.51	43.83	43.71	43.12	43.12	43.01	43.34	43.71	43.96	44.23	(38)

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

(39)m=	181.3	181.15	181.01	180.33	180.2	179.61	179.61	179.5	179.84	180.2	180.46	180.73

Average = Sum(39)$_{1…12}$ /12= — 180.33 (39)

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

(40)m=	1.71	1.71	1.71	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.71	1.71

Average = Sum(40)$_{1…12}$ /12= — 1.7 (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 — 2.79 (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 — 100.39 (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=	110.43	106.41	102.4	98.38	94.37	90.35	90.35	94.37	98.38	102.4	106.41	110.43

Total = Sum(44)$_{1…12}$ = — 1204.67 (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=	163.76	143.23	147.8	128.85	123.64	106.69	98.86	113.45	114.8	133.79	146.04	158.59

Total = Sum(45)$_{1…12}$ = — 1579.51 (45)

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

(46)m=	24.56	21.48	22.17	19.33	18.55	16	14.83	17.02	17.22	20.07	21.91	23.79	(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) = — 0 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	50.96	46.03	50.96	48.52	48.09	44.56	46.04	48.09	48.52	50.96	49.32	50.96	(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=	214.72	189.25	198.76	177.37	171.73	151.25	144.91	161.54	163.32	184.75	195.36	209.55	(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=	214.72	189.25	198.76	177.37	171.73	151.25	144.91	161.54	163.32	184.75	195.36	209.55

Output from water heater (annual)$_{1...12}$ 2162.5 (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=	67.19	59.13	61.88	54.97	53.13	46.61	44.38	49.74	50.3	57.23	60.89	65.47	(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=	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	139.35	(66)

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

(67)m=	23.65	21.01	17.09	12.94	9.67	8.16	8.82	11.47	15.39	19.54	22.81	24.31	(67)

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

(68)m=	265.33	268.09	261.15	246.38	227.73	210.21	198.5	195.75	202.69	217.46	236.1	253.63	(68)

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

(69)m=	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	-111.48	(71)

Water heating gains (Table 5)

(72)m=	90.31	87.99	83.18	76.35	71.41	64.74	59.65	66.86	69.86	76.92	84.57	88	(72)

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

(73)m=	447.1	444.89	429.21	403.47	376.62	350.92	334.78	341.88	355.74	381.72	411.28	433.74	(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	5.88	x	11.28	x	0.76	x	0.7	=	24.46	(75)
Northeast 0.9x	0.77	x	5.88	x	22.97	x	0.76	x	0.7	=	49.79	(75)
Northeast 0.9x	0.77	x	5.88	x	41.38	x	0.76	x	0.7	=	89.7	(75)
Northeast 0.9x	0.77	x	5.88	x	67.96	x	0.76	x	0.7	=	147.32	(75)
Northeast 0.9x	0.77	x	5.88	x	91.35	x	0.76	x	0.7	=	198.02	(75)
Northeast 0.9x	0.77	x	5.88	x	97.38	x	0.76	x	0.7	=	211.11	(75)
Northeast 0.9x	0.77	x	5.88	x	91.1	x	0.76	x	0.7	=	197.49	(75)
Northeast 0.9x	0.77	x	5.88	x	72.63	x	0.76	x	0.7	=	157.44	(75)
Northeast 0.9x	0.77	x	5.88	x	50.42	x	0.76	x	0.7	=	109.3	(75)
Northeast 0.9x	0.77	x	5.88	x	28.07	x	0.76	x	0.7	=	60.84	(75)
Northeast 0.9x	0.77	x	5.88	x	14.2	x	0.76	x	0.7	=	30.78	(75)
Northeast 0.9x	0.77	x	5.88	x	9.21	x	0.76	x	0.7	=	19.97	(75)
Southeast 0.9x	0.77	x	5.51	x	36.79	x	0.76	x	0.7	=	74.72	(77)
Southeast 0.9x	0.77	x	5.51	x	62.67	x	0.76	x	0.7	=	127.27	(77)
Southeast 0.9x	0.77	x	5.51	x	85.75	x	0.76	x	0.7	=	174.14	(77)
Southeast 0.9x	0.77	x	5.51	x	106.25	x	0.76	x	0.7	=	215.76	(77)
Southeast 0.9x	0.77	x	5.51	x	119.01	x	0.76	x	0.7	=	241.67	(77)
Southeast 0.9x	0.77	x	5.51	x	118.15	x	0.76	x	0.7	=	239.92	(77)
Southeast 0.9x	0.77	x	5.51	x	113.91	x	0.76	x	0.7	=	231.31	(77)
Southeast 0.9x	0.77	x	5.51	x	104.39	x	0.76	x	0.7	=	211.98	(77)
Southeast 0.9x	0.77	x	5.51	x	92.85	x	0.76	x	0.7	=	188.55	(77)
Southeast 0.9x	0.77	x	5.51	x	69.27	x	0.76	x	0.7	=	140.66	(77)
Southeast 0.9x	0.77	x	5.51	x	44.07	x	0.76	x	0.7	=	89.49	(77)
Southeast 0.9x	0.77	x	5.51	x	31.49	x	0.76	x	0.7	=	63.94	(77)
Southwest 0.9x	0.77	x	8.56	x	36.79		0.76	x	0.7	=	116.12	(79)
Southwest 0.9x	0.77	x	8.56	x	62.67		0.76	x	0.7	=	197.79	(79)
Southwest 0.9x	0.77	x	8.56	x	85.75		0.76	x	0.7	=	270.62	(79)
Southwest 0.9x	0.77	x	8.56	x	106.25		0.76	x	0.7	=	335.32	(79)
Southwest 0.9x	0.77	x	8.56	x	119.01		0.76	x	0.7	=	375.58	(79)
Southwest 0.9x	0.77	x	8.56	x	118.15		0.76	x	0.7	=	372.87	(79)
Southwest 0.9x	0.77	x	8.56	x	113.91		0.76	x	0.7	=	359.48	(79)
Southwest 0.9x	0.77	x	8.56	x	104.39		0.76	x	0.7	=	329.44	(79)
Southwest 0.9x	0.77	x	8.56	x	92.85		0.76	x	0.7	=	293.03	(79)
Southwest 0.9x	0.77	x	8.56	x	69.27		0.76	x	0.7	=	218.6	(79)
Southwest 0.9x	0.77	x	8.56	x	44.07		0.76	x	0.7	=	139.08	(79)
Southwest 0.9x	0.77	x	8.56	x	31.49		0.76	x	0.7	=	99.37	(79)
Northwest 0.9x	0.77	x	20.08	x	11.28	x	0.76	x	0.7	=	83.53	(81)
Northwest 0.9x	0.77	x	20.08	x	22.97	x	0.76	x	0.7	=	170.02	(81)
Northwest 0.9x	0.77	x	20.08	x	41.38	x	0.76	x	0.7	=	306.33	(81)

Northwest 0.9x	0.77	x	20.08	x	67.96	x	0.76	x	0.7	=	503.08	(81)
Northwest 0.9x	0.77	x	20.08	x	91.35	x	0.76	x	0.7	=	676.24	(81)
Northwest 0.9x	0.77	x	20.08	x	97.38	x	0.76	x	0.7	=	720.94	(81)
Northwest 0.9x	0.77	x	20.08	x	91.1	x	0.76	x	0.7	=	674.42	(81)
Northwest 0.9x	0.77	x	20.08	x	72.63	x	0.76	x	0.7	=	537.66	(81)
Northwest 0.9x	0.77	x	20.08	x	50.42	x	0.76	x	0.7	=	373.26	(81)
Northwest 0.9x	0.77	x	20.08	x	28.07	x	0.76	x	0.7	=	207.78	(81)
Northwest 0.9x	0.77	x	20.08	x	14.2	x	0.76	x	0.7	=	105.1	(81)
Northwest 0.9x	0.77	x	20.08	x	9.21	x	0.76	x	0.7	=	68.21	(81)
Rooflights 0.9x	1	x	11.91	x	26	x	0.76	x	0.7	=	296.53	(82)
Rooflights 0.9x	1	x	11.91	x	54	x	0.76	x	0.7	=	615.87	(82)
Rooflights 0.9x	1	x	11.91	x	96	x	0.76	x	0.7	=	1094.88	(82)
Rooflights 0.9x	1	x	11.91	x	150	x	0.76	x	0.7	=	1710.75	(82)
Rooflights 0.9x	1	x	11.91	x	192	x	0.76	x	0.7	=	2189.76	(82)
Rooflights 0.9x	1	x	11.91	x	200	x	0.76	x	0.7	=	2281	(82)
Rooflights 0.9x	1	x	11.91	x	189	x	0.76	x	0.7	=	2155.55	(82)
Rooflights 0.9x	1	x	11.91	x	157	x	0.76	x	0.7	=	1790.59	(82)
Rooflights 0.9x	1	x	11.91	x	115	x	0.76	x	0.7	=	1311.58	(82)
Rooflights 0.9x	1	x	11.91	x	66	x	0.76	x	0.7	=	752.73	(82)
Rooflights 0.9x	1	x	11.91	x	33	x	0.76	x	0.7	=	376.37	(82)
Rooflights 0.9x	1	x	11.91	x	21	x	0.76	x	0.7	=	239.51	(82)

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

(83)m=	595.35	1160.74	1935.67	2912.22	3681.27	3825.84	3618.26	3027.11	2275.72	1380.62	740.81	491.01	(83)

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

(84)m=	1042.45	1605.63	2364.88	3315.69	4057.89	4176.76	3953.03	3368.99	2631.46	1762.33	1152.09	924.75	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.95	0.83	0.6	0.4	0.27	0.2	0.24	0.46	0.81	0.97	0.99	(86)

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

(87)m=	19.39	19.88	20.46	20.85	20.97	20.99	21	21	20.97	20.64	19.88	19.29	(87)

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

(88)m=	19.53	19.53	19.53	19.54	19.54	19.54	19.54	19.54	19.54	19.54	19.54	19.53	(88)

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

(89)m=	0.98	0.93	0.79	0.54	0.34	0.21	0.13	0.17	0.37	0.75	0.96	0.99	(89)

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

(90)m=	17.48	18.17	18.94	19.4	19.52	19.54	19.54	19.54	19.52	19.2	18.19	17.34	(90)

fLA = Living area ÷ (4) = | 0.43 | (91)

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

(92)m=	18.3	18.9	19.59	20.02	20.14	20.16	20.17	20.17	20.14	19.82	18.91	18.18	(92)

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

(93)m=	18.15	18.75	19.44	19.87	19.99	20.01	20.02	20.02	19.99	19.67	18.76	18.03	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.92	0.78	0.56	0.36	0.23	0.16	0.19	0.39	0.76	0.95	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1018.52	1479.52	1853.6	1850.45	1470.68	969.11	613.22	648.04	1037.9	1334.61	1093.01	910.03	(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=	2511.2	2509.34	2343.02	1978.98	1493.88	972.38	613.72	649.17	1059.61	1634.12	2104.74	2499.24	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1110.56	692.04	364.13	92.54	17.26	0	0	0	0	222.84	728.45	1182.37	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4410.19 (98)

Space heating requirement in kWh/m²/year 41.7 (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		90.8	(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)													
	1110.56	692.04	364.13	92.54	17.26	0	0	0	0	222.84	728.45	1182.37	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1223.08	762.16	401.02	101.92	19.01	0	0	0	0	245.42	802.26	1302.17	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4857.04 (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)

Water heating

Output from water heater (calculated above)

	214.72	189.25	198.76	177.37	171.73	151.25	144.91	161.54	163.32	184.75	195.36	209.55	
Efficiency of water heater												81.5	(216)
(217)m=	89.15	88.63	87.28	84.47	82.27	81.5	81.5	81.5	81.5	86.33	88.66	89.27	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	240.85	213.54	227.71	209.99	208.73	185.58	177.8	198.2	200.39	213.99	220.34	234.75

Total = Sum(219a)$_{1...12}$ = 2531.88 (219)

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			4857.04	
Water heating fuel used			2531.88	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		30	(231)
Electricity for lighting			417.75	(232)
Electricity generated by PVs			-855.55	(233)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1049.12	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	546.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1596.01	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	15.57	(267)
Electricity for lighting	(232) x	0.519	=	216.81	(268)
Energy saving/generation technologies Item 1		0.519	=	-444.03	(269)
Total CO2, kg/year		sum of (265)…(271) =		1384.36	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		13.09	(273)
EI rating (section 14)				88	(274)

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May 2009 version - Revision 00

Job no:	West End Lane
Assessment date:	
Assessor name:	
Registration no:	
Development name:	

Help Assistant

What is this red triangle?

ENE 7 ASSESSMENT TOOL

		1	2	3	4	5	6
Description		BOX NUMBER	MST1	APT2			
SAP Reference No.		1					
Define dwelling heating system from drop down list		Click to select	Individual heating systems	Individual heating systems	Click to select	Individual heating systems	Individual heating systems

All values to be taken from the box numbers described within the worksheets set out in the Government's Standard Assessment Procedure for the Energy Rating of Dwellings, 2005 edition, revision 2, June 2008.

Part 1: STANDARD System Specification CO_2 emissions (no LZC technologies)

			1	2	3	4	5	6
CO_2 emissions from space & water heating (from Standard case SAP 2005 DER worksheet)	(SAP box 107)	$kgCO_2/yr$						
CO_2 emissions from fans and pumps (from Standard case SAP 2005 DER worksheet)	(SAP box 108)	$kgCO_2/yr$						
CO_2 emissions from lighting (from Standard case SAP 2005 DER worksheet)	(SAP box 109)	$kgCO_2/yr$						
Energy demand from mechanical cooling		kWh/yr supplied						
CO_2 emissions from mechanical cooling		$kgCO_2/yr$						
Total Floor Area	(SAP box 5)	m^2	89.19	52.08	104.77			
CO_2 emissions from appliances & cooking		$kgCO_2/yr$	1197.99	824.89	1276.41			
Total CO_2 emissions from Standard case system specification		$kgCO_2/yr$						

Part 2: ACTUAL System Specification CO_2 Emissions (including LZC technologies)

			1	2	3	4	5	6
CO_2 emissions from fans and pumps (from SAP 2005 DER worksheet)				Enter value from SAP box 108	Enter value from SAP box 108		Enter value from SAP box 108	Enter value from SAP box 108
	(SAP box 108)	$kgCO_2/yr$						
	(SAP box 114*)	$kgCO_2/yr$						
Reduction in CO_2 emissions for pumps and fans in actual dwelling specification		$kgCO_2/yr$		0.00	0.00		0.00	0.00
CO_2 emissions from space heating and hot water (from SAP 2005 DER worksheet)				Enter value from SAP box 107	Enter value from SAP box 107		Enter value from SAP box 107	Enter value from SAP box 107
	(SAP box 107)	$kgCO_2/yr$						
	(SAP box 115*)	$kgCO_2/yr$						
CO_2 reduction for space and water heating from LZC technologies covered by SAP2005		kgCO2/yr		0.00	0.00		0.00	0.00
CO_2 reduction from electricity generated by LZC technologies covered in SAP 2005 (from DER worksheet)				Enter below figures from SAP 110 and SAP 111	Enter below figures from SAP 110 and SAP 111		Enter below figures from SAP 110 and SAP 111	Enter below figures from SAP 110 and SAP 111
	(SAP box 110)	$kgCO_2/yr$						
	(SAP box 111)	$kgCO_2/yr$						
	(SAP box 117*)	$kgCO_2/yr$						
	(SAP box 118*)	$kgCO_2/yr$						
CO_2 reduction from electricity generated by LZC technologies covered in SAP		$kgCO_2/yr$		0.00	0.00		0.00	0.00
CO_2 reduction from additional allowable electricity generation considered in section 14 of SAP 2005	(SAP box ZC7)	$kgCO_2/m^2/yr$						
	(SAP box 5)	m^2	89.19	52.08	104.77	0.00	0.00	0.00
		$kgCO_2/yr$						
Is a community biomass CHP space and/or water heating system present?	Select from drop down menus							
Is system a DHW only community CHP scheme?								
Is SAP box [107] set to 0?								
Is SAP box [115*] set to 0?								
	(SAP box 108*)	$kgCO_2/yr$						
	(SAP box 110*)	$kgCO_2/yr$						
	(SAP box 111*)	$kgCO_2/yr$						
	(SAP box 112*)	$kgCO_2/yr$						
	(SAP box 113*)	$kgCO_2/yr$						
CO2 emissions offset for community biomass CHP (from SAP 2005 DER worksheet)		$kgCO_2/yr$		0.00	0.00		0.00	0.00

*** Please see section C4 of the Government's Standard Assessment procedure for Energy Rating of Dwellings (Revision 2, June 2008) for more details of DHW - only community schemes.**

Part 3: CO_2 reduction from generation

		1	2	3	4	5	6
CO_2 reduction from LZC electricity generation	$kgCO_2/yr$						
CO_2 reduction from LZC thermal generation	$kgCO_2/yr$		0.00	0.00		0.00	0.00
Total CO_2 reduction from specified LZC technologies	$kgCO_2/yr$						

Part 4: Percentage of CO_2 saving as a result of using LZC systems

		1	2	3	4	5	6
CO_2 saving as a percentage of standard case CO2 emissions ('Actual' over 'Standard Case')	% reduction in CO_2 emissions						
	Credits Achieved						

Part G Compliance Report

PROJECT DETAILS

Project Reference:
Client:
Property: West End Lane

Local Authority:
Agent:

Assessor:
Address:
Contact:
Software: G-Calc 2015 version 3.0.2
Prepared on: 19-Feb-16

RESULT SUMMARY

By following the Government's national calculation methodology for assessing water efficiency in new dwellings this 2 bed dwelling, as designed, achieves a water consumption of 104.6 litres per person per day.

Compliance with Building Regulation 36(1) has been demonstrated.

Table 1: The Water Calculator for New Dwellings					
Installation Type	Unit of measure	Value	Use factor	Fixed use	litres/person/day
WC(single flush)	Flush volume (litres)		4.42	0.00	
WC(dual flush)	Full flush vol.	4	1.46	0.00	5.84
	Part flush vol.	2.5	2.96	0.00	7.4
WC(multiple fittings)	Average effective Flush vol. (litres)	0	4.42	0.00	0
Taps(excl. Kitchen)	Flow rate (litres/min)	5	1.58	1.58	9.48
Bath (shower also present)	Capacity to overflow (litres)	170	0.11	0.00	18.7
Shower (bath also present)	Flow rate (litres/min)	8	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)	0	0.50	0.00	0
Shower only	Flow rate (litres/minute)	0	5.6	0.00	0
Kitchen sink taps	Flow rate (litres/minute)	6	0.44	10.36	13
Washing Machine	litres/kg dry load	7.5	2.1	0.0	15.75
Dishwasher	litres/place setting	1.20	3.6	0.0	4.32
Waste disposal	litres/use	0	3.08	0.0	0
Water softener	litres/person/day	0	1.0	0.0	0
		Total calculated use (litres/person/day)			109.45
		Contribution from greywater (litres/person/day)			-
		Contribution from rainwater (litres/person/day)			-
		Normalisation factor			0.91
		Total Water Consumption. Code for Sustainable Homes (litres/person/day)			**99.6**
		External water use			5.0
		Total Water Consumption. (36(1)) (litres/person/day)			**104.6**

Summary of fitting types "As Designed"			
Type	Description	Flow rates, volumes etc.	Qty
Taps	TBC	5 litres/min	1
Baths	TBC	170 litres to overflow	1
Dishwashers	TBC	1.20 litres/place	1
Washing Machines	TBC	7.5 litres/kg	1
Showers	TBC	8 litres/min	1
WC's	TBC	4 / 2.5 litres flush vols.	1
Kitchen/Utility taps	TBC	6 litres/min	1

The lower section of this table is to be filled in by the builder prior to completion. The descriptions, values and quantities should represent the 'as built' specification. Please note the values above represent design values and should not be exceeded without prior consultation with the agent/designer ().
The completed table should be returned to the assessor: the agent/designer.

Declaration of fitting types "As Built"			
Type	Make and Model	Flow rates, volumes etc.	Qty
Taps			
Baths			
Dishwashers			
Washing Machines			
Showers			
WC's			
Kitchen/Utility taps			

Project ref: - West End Lane

The above declaration of fittings, values and quantities is a true reflection of those installed on this project.

Name: .... Signature: .... Date: ....

------End of Report------