DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 7

Address : Flat_7

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	69.91	(1a) x	2.7	(2a) =	188.76	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	69.91	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		188.76	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 2			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Floor			69.91	x	0.12	=	8.3892	110	7690.101	(28)
Walls Type1	50.38	11.16	39.22	x	0.18	=	7.06	70	2745.4	(29)
Walls Type2	8.1	0	8.1	x	0.23	=	1.89	70	567	(29)
Walls Type3	21.44	1.89	19.55	x	0.23	=	4.57	70	1368.5	(29)
Total area of elements, m²			149.83							(31)
Party wall			18.14	x	0	=	0	45	816.3	(32)
Party ceiling			69.91					30	2097.3	(32b)
Internal wall **			80					9	720	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16004.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 228.93 (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 12.12 (36)

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

Total fabric heat loss (33) + (36) = 51.48 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	17.45	17.25	17.05	16.06	15.86	14.86	14.86	14.67	15.26	15.86	16.25	16.65	(38)

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

(39)m=	68.92	68.72	68.52	67.53	67.33	66.34	66.34	66.14	66.74	67.33	67.73	68.13	

Average = Sum(39)$_{1...12}$ /12= 67.48 (39)

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

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

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.24 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.49 (43)

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

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

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

(44)m=	96.24	92.74	89.24	85.74	82.24	78.74	78.74	82.24	85.74	89.24	92.74	96.24	

Total = Sum(44)$_{1...12}$ = 1049.92 (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=	142.73	124.83	128.81	112.3	107.76	92.99	86.16	98.87	100.06	116.61	127.28	138.22	

Total = Sum(45)$_{1...12}$ = 1376.61 (45)

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

(46)m=	21.41	18.72	19.32	16.85	16.16	13.95	12.92	14.83	15.01	17.49	19.09	20.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.19 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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) 0.71 (55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	188.12	165.83	174.21	156.23	153.15	136.92	131.56	144.27	143.99	162	171.22	183.62	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	188.12	165.83	174.21	156.23	153.15	136.92	131.56	144.27	143.99	162	171.22	183.62	

Output from water heater (annual)$_{1,12}$ | 1911.12 | (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=	83.77	74.31	79.15	72.49	72.15	66.06	64.97	69.19	68.41	75.09	77.47	82.28	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	112.2	112.2	112.2	112.2	112.2	112.2	112.2	112.2	112.2	112.2	112.2	112.2	(66)

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

(67)m=	18.34	16.29	13.25	10.03	7.5	6.33	6.84	8.89	11.93	15.15	17.68	18.85	(67)

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

(68)m=	197.09	199.13	193.98	183.01	169.16	156.14	147.44	145.4	150.55	161.52	175.37	188.39	(68)

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

(69)m=	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-89.76	-89.76	-89.76	-89.76	-89.76	-89.76	-89.76	-89.76	-89.76	-89.76	-89.76	-89.76	(71)

Water heating gains (Table 5)

(72)m=	112.6	110.58	106.38	100.67	96.97	91.75	87.32	93	95.02	100.93	107.59	110.59	(72)

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

(73)m=	384.68	382.66	370.26	350.37	330.28	310.88	298.26	303.95	314.16	334.26	357.31	374.48	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x 0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x 0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x 0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x 0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)

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East	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
East	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)

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

(83)m=	57.3	111.57	184.88	275.13	344.43	356.36	337.68	284.79	216.48	132.47	71.29	47.25	(83)

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

(84)m=	441.98	494.23	555.15	625.5	674.72	667.24	635.94	588.74	530.65	466.73	428.6	421.73	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.81	0.62	0.46	0.51	0.78	0.96	0.99	1	(86)

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

(87)m=	19.94	20.08	20.33	20.65	20.88	20.98	21	20.99	20.93	20.62	20.23	19.92	(87)

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

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

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

(89)m=	0.99	0.99	0.97	0.91	0.76	0.54	0.37	0.42	0.71	0.94	0.99	1	(89)

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

(90)m=	18.68	18.89	19.25	19.7	20	20.11	20.12	20.13	20.06	19.68	19.11	18.66	(90)

fLA = Living area ÷ (4) = 0.56 (91)

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

(92)m=	19.39	19.55	19.85	20.23	20.49	20.6	20.61	20.61	20.55	20.2	19.73	19.36	(92)

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

(93)m=	19.39	19.55	19.85	20.23	20.49	20.6	20.61	20.61	20.55	20.2	19.73	19.36	(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	0.99	0.97	0.91	0.78	0.58	0.42	0.47	0.74	0.95	0.99	1	(94)

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

(95)m=	439.24	488.43	539.2	572.29	528.83	387.92	264.77	276.02	395.17	441.26	423.34	419.66	(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=	1039.71	1007.11	914.86	765.24	591.95	397.77	266.1	278.46	430.27	646.68	855.75	1032.92	(97)

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

(98)m=	446.75	348.56	279.49	138.92	46.96	0	0	0	0	152.84	311.34	456.27

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2181.13 (98)

Space heating requirement in kWh/m²/year 31.2 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community boilers 1 (303a)

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

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

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		2181.13	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2290.18	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		1911.12	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2006.68	(310a)
Electricity used for heat distribution	0.01 × [(307a)...(307e) + (310a)...(310e)] =	42.97	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		149.68	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	149.68	(331)
Energy for lighting (calculated in Appendix L)		323.88	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4770.42	(338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
CO2 from other sources of space and water heating (not CHP)				
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		91	(367a)

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CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	1019.91	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	22.3	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1042.21	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1042.21	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	77.69	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	168.09	(379)
Total CO2, kg/year	sum of (376)…(382) =			1287.99	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.42	(384)
EI rating (section 14)				84.98	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 8

Address : Flat_8

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	88.4	(1a) x	2.7	(2a) =	238.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	88.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		238.68	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				3 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15 (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) =			0.13 (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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 2			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 3			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 5			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Floor			88.4	x	0.12	=	10.608	110	9724	(28)
Walls Type1	56.65	12.92	43.73	x	0.18	=	7.87	70	3061.1	(29)
Walls Type2	13.69	0	13.69	x	0.23	=	3.2	70	958.3	(29)
Walls Type3	21.98	1.89	20.09	x	0.23	=	4.7	70	1406.3	(29)
Total area of elements, m²			180.72							(31)
Party wall			28.38	x	0	=	0	45	1277.1	(32)
Party ceiling			88.4					30	2652	(32b)
Internal wall **			80					9	720	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.15 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19798.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 223.97 (35)

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

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 14.98 (36)

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

Total fabric heat loss (33) + (36) = 61.14 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	22.06	21.81	21.56	20.3	20.05	18.8	18.8	18.54	19.3	20.05	20.55	21.05	(38)

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

(39)m=	83.2	82.95	82.69	81.44	81.19	79.93	79.93	79.68	80.44	81.19	81.69	82.19	

Average = Sum(39)$_{1...12}$ /12= 81.38 (39)

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

(40)m=	0.94	0.94	0.94	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.93	

Average = Sum(40)$_{1...12}$ /12= 0.92 (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 — 2.6 (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 — 96.03 (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=	105.63	101.79	97.95	94.11	90.26	86.42	86.42	90.26	94.11	97.95	101.79	105.63	

Total = Sum(44)$_{1...12}$ = 1152.31 (44)

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

(45)m=	156.64	137	141.37	123.25	118.26	102.05	94.57	108.52	109.81	127.98	139.7	151.7	

Total = Sum(45)$_{1...12}$ = 1510.86 (45)

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

(46)m=	23.5	20.55	21.21	18.49	17.74	15.31	14.19	16.28	16.47	19.2	20.95	22.76	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.19 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.71	(55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	202.04	178	186.77	167.18	163.66	145.98	139.96	153.91	153.74	173.37	183.63	197.1	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	202.04	178	186.77	167.18	163.66	145.98	139.96	153.91	153.74	173.37	183.63	197.1	

Output from water heater (annual)$_{1...12}$ 2045.36 (64)

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

(65)m=	88.4	78.36	83.32	76.13	75.64	69.08	67.76	72.4	71.66	78.87	81.59	86.76	(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=	130.16	130.16	130.16	130.16	130.16	130.16	130.16	130.16	130.16	130.16	130.16	130.16	(66)

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

(67)m=	22.37	19.87	16.16	12.23	9.15	7.72	8.34	10.84	14.56	18.48	21.57	22.99	(67)

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

(68)m=	236.1	238.55	232.38	219.24	202.64	187.05	176.63	174.18	180.36	193.5	210.09	225.69	(68)

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

(69)m=	36.02	36.02	36.02	36.02	36.02	36.02	36.02	36.02	36.02	36.02	36.02	36.02	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	(71)

Water heating gains (Table 5)

(72)m=	118.82	116.6	111.99	105.73	101.67	95.94	91.08	97.31	99.53	106.01	113.33	116.61	(72)

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

(73)m=	439.34	437.07	422.58	399.25	375.5	352.76	338.1	344.39	356.49	380.04	407.04	427.34	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x 0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x 0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x 0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x 0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x 0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x 0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x 0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
East	0.9x 0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x 0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x 0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x 0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x 0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x 0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x 0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x 0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x 0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x 0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x 0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x 0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x 0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)

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South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)
South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)
South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)

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

(83)m=	121.3	213.26	305.12	393.34	449.42	448.69	431.64	390.32	336.23	239.71	146.6	102.9	(83)

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

(84)m=	560.64	650.33	727.7	792.59	824.92	801.46	769.74	734.7	692.71	619.75	553.64	530.24	(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	0.97	0.92	0.81	0.62	0.45	0.49	0.74	0.94	0.99	1	(86)

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

(87)m=	20	20.16	20.41	20.69	20.89	20.98	21	21	20.95	20.69	20.29	19.97	(87)

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

(88)m=	20.13	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.14	(88)

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

(89)m=	0.99	0.99	0.97	0.9	0.76	0.55	0.37	0.41	0.67	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=	18.79	19.03	19.38	19.79	20.05	20.15	20.16	20.16	20.12	19.79	19.22	18.76	(90)

fLA = Living area ÷ (4) = 0.32 (91)

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

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(92)m=	19.17	19.39	19.71	20.08	20.31	20.41	20.43	20.43	20.38	20.07	19.56	19.14	(92)

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

(93)m=	19.17	19.39	19.71	20.08	20.31	20.41	20.43	20.43	20.38	20.07	19.56	19.14	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.9	0.77	0.57	0.4	0.43	0.69	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	556.37	639.43	698.85	711.94	634.37	455.13	304.84	319.17	478.18	571.33	544.54	527.15	(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=	1237.23	1202.04	1092.21	910.11	699.31	464.69	305.9	320.92	505.26	769.23	1017.99	1227.9	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	506.56	378.07	292.66	142.69	48.32	0	0	0	0	147.24	340.88	521.36	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2377.78 (98)

Space heating requirement in kWh/m²/year 26.9 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community boilers 1 (303a)

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

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

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 2377.78

Space heat from Community boilers (98) x (304a) x (305) x (306) = 2496.67 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 2045.36

If DHW from community scheme:

Water heat from Community boilers (64) x (303a) x (305) x (306) = 2147.63 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 46.44 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

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Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		189.27	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	189.27	(331)
Energy for lighting (calculated in Appendix L)		395.12	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5228.69	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1102.38	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	24.1	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	1126.49	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1126.49	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	98.23	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	205.07	(379)
Total CO2, kg/year	sum of (376)...(382) =				1429.78	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.17	(384)
EI rating (section 14)					85.64	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 9

Address : Flat_9

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	110.56 (1a)	x	2.7 (2a)	=	298.51	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	110.56 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		298.51	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 2			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 3			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 5			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 6			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Floor			110.56	x	0.12	=	13.2672	110	12161.6	(28)
Walls Type1	72.55	14.68	57.87	x	0.18	=	10.42	70	4050.9	(29)
Walls Type2	39.61	0	39.61	x	0.23	=	9.26	70	2772.7	(29)
Walls Type3	13.88	1.89	11.99	x	0.23	=	2.8	70	839.3	(29)
Total area of elements, m²			236.6							(31)
Party ceiling			110					30	3300	(32b)
Internal wall **			100					9	900	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 57.86 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 24024.5 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 217.3 (35)

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

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 15.92 (36)

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

Total fabric heat loss (33) + (36) = — 73.78 (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=	27.59	27.27	26.96	25.39	25.08	23.51	23.51	23.19	24.13	25.08	25.7	26.33	(38)

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

(39)m=	101.37	101.05	100.74	99.17	98.86	97.29	97.29	96.97	97.91	98.86	99.48	100.11	

Average = Sum(39)$_{1...12}$ /12= 99.09 (39)

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

(40)m=	0.92	0.91	0.91	0.9	0.89	0.88	0.88	0.88	0.89	0.89	0.9	0.91	

Average = Sum(40)$_{1...12}$ /12= 0.9 (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 — 2.82 (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 — 101.13 (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=	111.24	107.2	103.15	99.11	95.06	91.02	91.02	95.06	99.11	103.15	107.2	111.24	

Total = Sum(44)$_{1...12}$ = 1213.57 (44)

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

(45)m=	164.97	144.29	148.89	129.81	124.55	107.48	99.59	114.29	115.65	134.78	147.12	159.77	

Total = Sum(45)$_{1...12}$ = 1591.18 (45)

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

(46)m=	24.75	21.64	22.33	19.47	18.68	16.12	14.94	17.14	17.35	20.22	22.07	23.96	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.19 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.71 (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)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)	0.71	(55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	210.37	185.29	194.29	173.74	169.95	151.41	144.99	159.68	159.58	180.18	191.06	205.16	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	210.37	185.29	194.29	173.74	169.95	151.41	144.99	159.68	159.58	180.18	191.06	205.16	

Output from water heater (annual)$_{1...12}$ 2125.69 (64)

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

(65)m=	91.17	80.78	85.82	78.31	77.73	70.88	69.43	74.32	73.6	81.13	84.06	89.44	(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=	140.91	140.91	140.91	140.91	140.91	140.91	140.91	140.91	140.91	140.91	140.91	140.91	(66)

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

(67)m=	26.35	23.41	19.04	14.41	10.77	9.09	9.83	12.77	17.14	21.77	25.41	27.09	(67)

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

(68)m=	272.36	275.18	268.06	252.9	233.76	215.77	203.76	200.93	208.05	223.21	242.35	260.34	(68)

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

(69)m=	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-112.73	-112.73	-112.73	-112.73	-112.73	-112.73	-112.73	-112.73	-112.73	-112.73	-112.73	-112.73	(71)

Water heating gains (Table 5)

(72)m=	122.54	120.2	115.35	108.76	104.48	98.45	93.32	99.89	102.22	109.05	116.76	120.21	(72)

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

(73)m=	486.52	484.07	467.72	441.34	414.28	388.59	372.18	378.86	392.69	419.3	449.79	472.91	(73)

6. Solar gains:

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

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DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(76)
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(76)
East	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x 0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(76)
East	0.9x 0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x 0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x 0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(76)
East	0.9x 0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x 0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x 0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(76)
East	0.9x 0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x 0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x 0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(76)
East	0.9x 0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
East	0.9x 0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
West	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)

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West	0.9x	0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x	0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x	0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x	0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x	0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x	0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x	0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x	0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x	0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x	0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x	0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x	0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x	0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x	0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x	0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x	0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x	0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x	0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x	0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)
West	0.9x	0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)
West	0.9x	0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)

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

(83)m=	88.11	172.37	283.87	414.01	507.38	519.39	494.48	424.75	330.15	204.53	109.87	72.46	(83)

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

(84)m=	574.64	656.44	751.59	855.35	921.66	907.98	866.66	803.62	722.84	623.83	559.66	545.37	(84)

7. Mean internal temperature (heating season)

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

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

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

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(86)m=	1	1	0.99	0.95	0.85	0.66	0.49	0.55	0.82	0.97	1	1	(86)

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

(87)m=	19.89	20.03	20.28	20.61	20.86	20.97	21	20.99	20.91	20.58	20.18	19.87	(87)

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

(88)m=	20.15	20.16	20.16	20.17	20.17	20.18	20.18	20.19	20.18	20.17	20.17	20.16	(88)

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

(89)m=	1	0.99	0.98	0.93	0.8	0.58	0.4	0.45	0.75	0.96	0.99	1	(89)

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

(90)m=	18.65	18.86	19.23	19.7	20.03	20.17	20.18	20.18	20.11	19.67	19.08	18.62	(90)

fLA = Living area ÷ (4) =	0.3	(91)

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

(92)m=	19.02	19.22	19.55	19.98	20.28	20.41	20.43	20.43	20.35	19.94	19.41	19	(92)

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

(93)m=	19.02	19.22	19.55	19.98	20.28	20.41	20.43	20.43	20.35	19.94	19.41	19	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.81	0.61	0.43	0.48	0.77	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	572.57	651.39	735.57	795.64	745.71	549.48	370.71	387.18	555.95	598.49	555.45	543.88	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1492.64	1446.78	1314.65	1098.9	848.45	565.42	372.65	390.78	612.26	923.8	1225.09	1481.92	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	684.53	534.5	430.83	218.35	76.43	0	0	0	0	242.04	482.14	697.9	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3366.72	(98)
Space heating requirement in kWh/m²/year	30.45	(99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community boilers	1	(303a)
Fraction of total space heat from Community boilers (302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	1.05	(306)

Space heating	**kWh/year**
Annual space heating requirement	3366.72

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Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3535.06	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2125.69	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2231.97	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	57.67	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		236.72	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	236.72	(331)
Energy for lighting (calculated in Appendix L)		465.41	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		6469.16	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1368.88	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	29.93	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1398.81	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1398.81	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	122.86	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	241.55	(379)
Total CO2, kg/year	sum of (376)…(382) =				1763.21	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.95	(384)
EI rating (section 14)					84.81	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 10

Address : Flat_10

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54	(1a) x	2.7	(2a) =	145.8	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145.8	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 2			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Walls Type1	35.48	9.5	25.98	x	0.18	=	4.68	70	1818.6	(29)
Walls Type2	19.82	0	19.82	x	0.23	=	4.64	70	1387.4	(29)
Walls Type3	6.94	1.89	5.05	x	0.23	=	1.18	70	353.5	(29)
Total area of elements, m²			62.24							(31)
Party wall			23.14	x	0	=	0	45	1041.3	(32)
Party floor			54					40	2160	(32a)
Party ceiling			54					30	1620	(32b)
Internal wall **			60					9	540	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.73 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8920.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 165.2 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 7.3 (36)

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

Total fabric heat loss (33) + (36) = 33.03 (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=	13.47	13.32	13.17	12.4	12.25	11.48	11.48	11.33	11.79	12.25	12.55	12.86	(38)

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

(39)m=	46.5	46.35	46.2	45.43	45.28	44.51	44.51	44.36	44.82	45.28	45.58	45.89	

Average = Sum(39)$_{1...12}$ /12= 45.39 (39)

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

(40)m=	0.86	0.86	0.86	0.84	0.84	0.82	0.82	0.82	0.83	0.84	0.84	0.85	

Average = Sum(40)$_{1...12}$ /12= 0.84 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.81 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.14 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.85	81.77	78.68	75.6	72.51	69.43	69.43	72.51	75.6	78.68	81.77	84.85	

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

Total = Sum(44)$_{1...12}$ = 925.68 (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=	125.84	110.06	113.57	99.01	95	81.98	75.97	87.17	88.22	102.81	112.22	121.87	

Total = Sum(45)$_{1...12}$ = 1213.71 (45)

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

(46)m=	18.88	16.51	17.04	14.85	14.25	12.3	11.4	13.08	13.23	15.42	16.83	18.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.19 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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) 0.71 (55)

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DER WorkSheet: New dwelling design stage

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	171.23	151.06	158.97	142.94	140.4	125.91	121.36	132.57	132.15	148.2	156.15	167.26	(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=	171.23	151.06	158.97	142.94	140.4	125.91	121.36	132.57	132.15	148.2	156.15	167.26	

Output from water heater (annual)$_{1,12}$ | 1748.22 | (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=	78.16	69.4	74.08	68.07	67.91	62.4	61.58	65.3	64.48	70.5	72.46	76.84	(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=	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	(66)

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

(67)m=	14.4	12.79	10.4	7.88	5.89	4.97	5.37	6.98	9.37	11.9	13.89	14.81	(67)

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

(68)m=	157.6	159.24	155.12	146.35	135.27	124.86	117.91	116.27	120.39	129.17	140.24	150.65	(68)

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

(69)m=	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	(71)

Water heating gains (Table 5)

(72)m=	105.05	103.27	99.57	94.54	91.27	86.67	82.76	87.77	89.55	94.76	100.64	103.28	(72)

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

(73)m=	327.18	325.42	315.21	298.88	282.55	266.63	256.16	261.15	269.44	285.94	304.89	318.85	(73)

6. Solar gains:

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

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DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(76)
East	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(76)
East	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(76)
East	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(76)
East	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(76)
East	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(76)
East	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(76)
East	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(76)
East	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(76)
East	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(76)
East	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(76)
East	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(76)
East	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(76)
East	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(76)
East	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(76)
East	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(76)
East	0.9x 0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(76)
East	0.9x 0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(76)
East	0.9x 0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(76)
East	0.9x 0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(76)
East	0.9x 0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(76)
East	0.9x 0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(76)
East	0.9x 0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(76)
East	0.9x 0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(76)
West	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(80)
West	0.9x 0.77	x	2.16	x	19.64	x	0.63	x	0.7	=	12.97	(80)
West	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(80)
West	0.9x 0.77	x	2.16	x	38.42	x	0.63	x	0.7	=	25.36	(80)
West	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(80)
West	0.9x 0.77	x	2.16	x	63.27	x	0.63	x	0.7	=	41.77	(80)
West	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(80)
West	0.9x 0.77	x	2.16	x	92.28	x	0.63	x	0.7	=	60.92	(80)
West	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(80)
West	0.9x 0.77	x	2.16	x	113.09	x	0.63	x	0.7	=	74.66	(80)
West	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(80)
West	0.9x 0.77	x	2.16	x	115.77	x	0.63	x	0.7	=	76.42	(80)
West	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(80)
West	0.9x 0.77	x	2.16	x	110.22	x	0.63	x	0.7	=	72.76	(80)
West	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(80)

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DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.16	x	94.68	x	0.63	x	0.7	=	62.5	(80)
West	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(80)
West	0.9x	0.77	x	2.16	x	73.59	x	0.63	x	0.7	=	48.58	(80)
West	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(80)
West	0.9x	0.77	x	2.16	x	45.59	x	0.63	x	0.7	=	30.09	(80)
West	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(80)
West	0.9x	0.77	x	2.16	x	24.49	x	0.63	x	0.7	=	16.17	(80)
West	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(80)
West	0.9x	0.77	x	2.16	x	16.15	x	0.63	x	0.7	=	10.66	(80)

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

(83)m=	57.02	111.55	183.7	267.92	328.34	336.12	320	274.87	213.65	132.36	71.1	46.89	(83)

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

(84)m=	384.2	436.97	498.91	566.8	610.89	602.74	576.16	536.02	483.09	418.3	375.99	365.74	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.92	0.81	0.65	0.47	0.34	0.38	0.61	0.87	0.96	0.98	(86)

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

(87)m=	19.97	20.17	20.46	20.77	20.93	20.99	21	21	20.96	20.72	20.3	19.94	(87)

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

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

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

(89)m=	0.97	0.95	0.9	0.78	0.6	0.41	0.28	0.32	0.55	0.84	0.95	0.98	(89)

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

(90)m=	18.83	19.11	19.52	19.95	20.15	20.22	20.23	20.23	20.19	19.9	19.31	18.79	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.37	19.61	19.96	20.33	20.52	20.58	20.59	20.59	20.56	20.29	19.78	19.34	(92)

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

(93)m=	19.37	19.61	19.96	20.33	20.52	20.58	20.59	20.59	20.56	20.29	19.78	19.34	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.97	0.95	0.9	0.78	0.62	0.44	0.31	0.35	0.58	0.84	0.95	0.97	(94)

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

(95)m=	372.54	414.46	448.02	444.88	378.26	263.16	177.24	185.17	278.24	352.19	356.23	356.43	(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=	700.86	681.63	621.88	519.42	399.33	266.36	177.73	185.99	289.35	438.66	577.94	694.59	(97)

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

(98)m=	244.27	179.54	129.35	53.67	15.68	0	0	0	0	64.34	159.63	251.59

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1098.07 (98)

Space heating requirement in kWh/m²/year 20.33 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community boilers 1 (303a)

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

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

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1098.07

Space heat from Community boilers (98) x (304a) x (305) x (306) = 1152.97 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1748.22

If DHW from community scheme:

Water heat from Community boilers (64) x (303a) x (305) x (306) = 1835.63 (310a)

Electricity used for heat distribution 0.01 × [(307a)...(307e) + (310a)...(310e)] = 29.89 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside 115.62 (330a)

warm air heating system fans 0 (330b)

pump for solar water heating 0 (330g)

Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 115.62 (331)

Energy for lighting (calculated in Appendix L) 254.39 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 3358.61 (338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel 91 (367a)

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DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	709.38	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	15.51	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	724.89	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			724.89	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	60.01	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	132.03	(379)
Total CO2, kg/year	sum of (376)…(382) =			916.93	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.98	(384)
EI rating (section 14)				87.59	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 11

Address : Flat_11

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	116 (1a)	x	2.7 (2a)	=	313.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	116 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		313.2	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 2			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 5			5	x	1/[1/(1.4)+ 0.04]	=	6.63			(27)
Windows Type 6			5	x	1/[1/(1.4)+ 0.04]	=	6.63			(27)
Walls Type1	72.06	17.04	55.02	x	0.18	=	9.9	70	3851.4	(29)
Walls Type2	5.1	1.89	3.21	x	0.23	=	0.75	70	224.7	(29)
Total area of elements, m²			77.16							(31)
Party wall			52.11	x	0	=	0	45	2344.95	(32)
Party floor			116					40	4640	(32a)
Party ceiling			116					30	3480	(32b)
Internal wall **			100					9	900	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.89 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 15441.05 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 133.11 (35)

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

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 11.38 (36)

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

Total fabric heat loss (33) + (36) = 47.28 (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=	28.95	28.62	28.29	26.64	26.31	24.66	24.66	24.33	25.32	26.31	26.97	27.63	(38)

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

(39)m=	76.22	75.89	75.56	73.92	73.59	71.94	71.94	71.61	72.6	73.59	74.24	74.9	

Average = Sum(39)$_{1...12}$ /12= 73.83 (39)

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

(40)m=	0.66	0.65	0.65	0.64	0.63	0.62	0.62	0.62	0.63	0.63	0.64	0.65	

Average = Sum(40)$_{1...12}$ /12= 0.64 (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 — 2.85 (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 — 101.8 (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=	111.98	107.91	103.84	99.77	95.69	91.62	91.62	95.69	99.77	103.84	107.91	111.98	

Total = Sum(44)$_{1...12}$ = 1221.64 (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=	166.07	145.24	149.88	130.67	125.38	108.19	100.26	115.05	116.42	135.68	148.1	160.83	

Total = Sum(45)$_{1...12}$ = 1601.76 (45)

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

(46)m=	24.91	21.79	22.48	19.6	18.81	16.23	15.04	17.26	17.46	20.35	22.22	24.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.19 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0 (54)
Enter (50) or (54) in (55)		0.71 (55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	211.46	186.25	195.28	174.6	170.78	152.12	145.65	160.44	160.35	181.07	192.03	206.22	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	211.46	186.25	195.28	174.6	170.78	152.12	145.65	160.44	160.35	181.07	192.03	206.22	

Output from water heater (annual)$_{1...12}$ 2136.26 (64)

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

(65)m=	91.53	81.1	86.15	78.59	78.01	71.12	69.65	74.57	73.86	81.43	84.39	89.79	(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=	142.32	142.32	142.32	142.32	142.32	142.32	142.32	142.32	142.32	142.32	142.32	142.32	(66)

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

(67)m=	26.5	23.53	19.14	14.49	10.83	9.14	9.88	12.84	17.24	21.89	25.55	27.23	(67)

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

(68)m=	279.91	282.81	275.5	259.91	240.24	221.76	209.41	206.5	213.82	229.4	249.07	267.56	(68)

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

(69)m=	37.23	37.23	37.23	37.23	37.23	37.23	37.23	37.23	37.23	37.23	37.23	37.23	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-113.86	-113.86	-113.86	-113.86	-113.86	-113.86	-113.86	-113.86	-113.86	-113.86	-113.86	-113.86	(71)

Water heating gains (Table 5)

(72)m=	123.03	120.68	115.8	109.16	104.85	98.78	93.62	100.23	102.58	109.45	117.21	120.69	(72)

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

(73)m=	495.13	492.72	476.13	449.26	421.62	395.37	378.6	385.27	399.33	426.43	457.52	481.18	(73)

6. Solar gains:

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

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DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)

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DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
South	0.9x	0.77	x	5	x	46.75	x	0.63	x	0.7	=	71.44	(78)
South	0.9x	0.77	x	5	x	46.75	x	0.63	x	0.7	=	71.44	(78)
South	0.9x	0.77	x	5	x	76.57	x	0.63	x	0.7	=	117	(78)
South	0.9x	0.77	x	5	x	76.57	x	0.63	x	0.7	=	117	(78)
South	0.9x	0.77	x	5	x	97.53	x	0.63	x	0.7	=	149.04	(78)
South	0.9x	0.77	x	5	x	97.53	x	0.63	x	0.7	=	149.04	(78)
South	0.9x	0.77	x	5	x	110.23	x	0.63	x	0.7	=	168.45	(78)
South	0.9x	0.77	x	5	x	110.23	x	0.63	x	0.7	=	168.45	(78)
South	0.9x	0.77	x	5	x	114.87	x	0.63	x	0.7	=	175.53	(78)
South	0.9x	0.77	x	5	x	114.87	x	0.63	x	0.7	=	175.53	(78)
South	0.9x	0.77	x	5	x	110.55	x	0.63	x	0.7	=	168.92	(78)
South	0.9x	0.77	x	5	x	110.55	x	0.63	x	0.7	=	168.92	(78)
South	0.9x	0.77	x	5	x	108.01	x	0.63	x	0.7	=	165.05	(78)
South	0.9x	0.77	x	5	x	108.01	x	0.63	x	0.7	=	165.05	(78)
South	0.9x	0.77	x	5	x	104.89	x	0.63	x	0.7	=	160.29	(78)
South	0.9x	0.77	x	5	x	104.89	x	0.63	x	0.7	=	160.29	(78)
South	0.9x	0.77	x	5	x	101.89	x	0.63	x	0.7	=	155.69	(78)
South	0.9x	0.77	x	5	x	101.89	x	0.63	x	0.7	=	155.69	(78)
South	0.9x	0.77	x	5	x	82.59	x	0.63	x	0.7	=	126.2	(78)
South	0.9x	0.77	x	5	x	82.59	x	0.63	x	0.7	=	126.2	(78)
South	0.9x	0.77	x	5	x	55.42	x	0.63	x	0.7	=	84.68	(78)
South	0.9x	0.77	x	5	x	55.42	x	0.63	x	0.7	=	84.68	(78)
South	0.9x	0.77	x	5	x	40.4	x	0.63	x	0.7	=	61.73	(78)
South	0.9x	0.77	x	5	x	40.4	x	0.63	x	0.7	=	61.73	(78)

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

(83)m=	165.76	277.72	372.37	456.22	511.81	509.94	490.77	448.04	400.7	304.44	197.58	142.53	(83)

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

(84)m=	660.89	770.45	848.49	905.48	933.43	905.31	869.37	833.31	800.03	730.87	655.11	623.71	(84)

7. Mean internal temperature (heating season)

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

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

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

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(86)m=	0.98	0.96	0.91	0.82	0.68	0.5	0.36	0.39	0.6	0.85	0.96	0.98	(86)

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

(87)m=	20.06	20.27	20.52	20.78	20.93	20.99	21	21	20.97	20.78	20.39	20.03	(87)

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

(88)m=	20.38	20.38	20.38	20.4	20.4	20.41	20.41	20.41	20.41	20.4	20.39	20.39	(88)

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

(89)m=	0.97	0.95	0.9	0.8	0.65	0.46	0.31	0.34	0.56	0.82	0.95	0.98	(89)

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

(90)m=	19.1	19.41	19.76	20.12	20.32	20.4	20.41	20.41	20.38	20.14	19.59	19.06	(90)

fLA = Living area ÷ (4) = 0.34 (91)

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

(92)m=	19.43	19.71	20.02	20.35	20.53	20.6	20.61	20.61	20.58	20.36	19.86	19.4	(92)

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

(93)m=	19.43	19.71	20.02	20.35	20.53	20.6	20.61	20.61	20.58	20.36	19.86	19.4	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.94	0.89	0.8	0.66	0.47	0.33	0.36	0.57	0.82	0.94	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	640.04	725.26	758.7	724.73	611.59	426.13	287.9	300.55	455.87	601.31	616.99	607.69	(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=	1153.55	1123.66	1021.77	846.28	649.75	431.88	288.7	301.76	470.6	718.14	947.72	1138.34	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	382.05	267.73	195.73	87.51	28.39	0	0	0	0	86.93	238.13	394.8	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1681.26 (98)

Space heating requirement in kWh/m²/year 14.49 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community boilers 1 (303a)

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

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

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating	**kWh/year**
Annual space heating requirement	1681.26

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Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1765.33	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2136.26	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2243.08	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.08	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		248.37	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	248.37	(331)
Energy for lighting (calculated in Appendix L)		467.92	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4724.69	(338)

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12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	951.45	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.8	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	972.25	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				972.25	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	128.9	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	242.85	(379)
Total CO2, kg/year	sum of (376)…(382) =				1344	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				11.59	(384)
EI rating (section 14)					88.81	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 12

Address : Flat_12

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78	(1a) x	2.7	(2a) =	210.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.6	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 2			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 3			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 4			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 5			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Walls Type1	56.62	14.12	42.5	x	0.18	=	7.65	70	2975	(29)
Walls Type2	8.1	0	8.1	x	0.23	=	1.89	70	567	(29)
Walls Type3	22.09	1.89	20.2	x	0.23	=	4.72	70	1414	(29)
Total area of elements, m²			86.81							(31)
Party wall			23.73	x	0	=	0	45	1067.85	(32)
Party floor			78					40	3120	(32a)
Party ceiling			78					30	2340	(32b)
Internal wall **			100					9	900	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12383.85 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 158.77 (35)

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

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 10.04 (36)

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

Total fabric heat loss (33) + (36) = — 45.67 (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=	19.46	19.24	19.02	17.91	17.69	16.58	16.58	16.36	17.03	17.69	18.13	18.58	(38)

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

(39)m=	65.14	64.92	64.69	63.59	63.36	62.26	62.26	62.04	62.7	63.36	63.81	64.25	

Average = Sum(39)$_{1...12}$ /12= 63.53 (39)

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

(40)m=	0.84	0.83	0.83	0.82	0.81	0.8	0.8	0.8	0.8	0.81	0.82	0.82	

Average = Sum(40)$_{1...12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.42 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 91.77 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	100.94	97.27	93.6	89.93	86.26	82.59	82.59	86.26	89.93	93.6	97.27	100.94	

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

Total = Sum(44)$_{1...12}$ = 1101.19 (44)

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

(45)m=	149.69	130.92	135.1	117.78	113.02	97.53	90.37	103.7	104.94	122.3	133.5	144.97	

Total = Sum(45)$_{1...12}$ = 1443.83 (45)

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

(46)m=	22.45	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.34	20.02	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.19 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.71 (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0 (54)
Enter (50) or (54) in (55)		0.71 (55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	195.09	171.93	180.5	161.72	158.41	141.46	135.77	149.1	148.87	167.7	177.43	190.37	(62)

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

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

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

Output from water heater

(64)m=	195.09	171.93	180.5	161.72	158.41	141.46	135.77	149.1	148.87	167.7	177.43	190.37	

Output from water heater (annual)$_{1...12}$ 1978.34 (64)

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

(65)m=	86.09	76.33	81.24	74.31	73.9	67.57	66.37	70.8	70.04	76.98	79.53	84.52	(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=	121.19	121.19	121.19	121.19	121.19	121.19	121.19	121.19	121.19	121.19	121.19	121.19	(66)

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

(67)m=	19.58	17.39	14.14	10.71	8	6.76	7.3	9.49	12.74	16.17	18.88	20.12	(67)

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

(68)m=	215.21	217.44	211.82	199.83	184.71	170.5	161	158.77	164.4	176.38	191.5	205.71	(68)

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

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	(71)

Water heating gains (Table 5)

(72)m=	115.71	113.59	109.19	103.21	99.32	93.85	89.2	95.16	97.28	103.47	110.46	113.6	(72)

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

(73)m=	409.86	407.78	394.51	373.11	351.39	330.46	316.86	322.78	333.77	355.38	380.2	398.8	(73)

6. Solar gains:

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

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DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	2.16	x	46.75	x	0.63	x	0.7	=	30.86	(78)
South	0.9x 0.77	x	2.16	x	46.75	x	0.63	x	0.7	=	30.86	(78)
South	0.9x 0.77	x	2.16	x	46.75	x	0.63	x	0.7	=	30.86	(78)
South	0.9x 0.77	x	2.16	x	76.57	x	0.63	x	0.7	=	50.54	(78)
South	0.9x 0.77	x	2.16	x	76.57	x	0.63	x	0.7	=	50.54	(78)
South	0.9x 0.77	x	2.16	x	76.57	x	0.63	x	0.7	=	50.54	(78)
South	0.9x 0.77	x	2.16	x	97.53	x	0.63	x	0.7	=	64.38	(78)
South	0.9x 0.77	x	2.16	x	97.53	x	0.63	x	0.7	=	64.38	(78)
South	0.9x 0.77	x	2.16	x	97.53	x	0.63	x	0.7	=	64.38	(78)
South	0.9x 0.77	x	2.16	x	110.23	x	0.63	x	0.7	=	72.77	(78)
South	0.9x 0.77	x	2.16	x	110.23	x	0.63	x	0.7	=	72.77	(78)
South	0.9x 0.77	x	2.16	x	110.23	x	0.63	x	0.7	=	72.77	(78)
South	0.9x 0.77	x	2.16	x	114.87	x	0.63	x	0.7	=	75.83	(78)
South	0.9x 0.77	x	2.16	x	114.87	x	0.63	x	0.7	=	75.83	(78)
South	0.9x 0.77	x	2.16	x	114.87	x	0.63	x	0.7	=	75.83	(78)
South	0.9x 0.77	x	2.16	x	110.55	x	0.63	x	0.7	=	72.98	(78)
South	0.9x 0.77	x	2.16	x	110.55	x	0.63	x	0.7	=	72.98	(78)
South	0.9x 0.77	x	2.16	x	110.55	x	0.63	x	0.7	=	72.98	(78)
South	0.9x 0.77	x	2.16	x	108.01	x	0.63	x	0.7	=	71.3	(78)
South	0.9x 0.77	x	2.16	x	108.01	x	0.63	x	0.7	=	71.3	(78)
South	0.9x 0.77	x	2.16	x	108.01	x	0.63	x	0.7	=	71.3	(78)
South	0.9x 0.77	x	2.16	x	104.89	x	0.63	x	0.7	=	69.24	(78)
South	0.9x 0.77	x	2.16	x	104.89	x	0.63	x	0.7	=	69.24	(78)
South	0.9x 0.77	x	2.16	x	104.89	x	0.63	x	0.7	=	69.24	(78)
South	0.9x 0.77	x	2.16	x	101.89	x	0.63	x	0.7	=	67.26	(78)
South	0.9x 0.77	x	2.16	x	101.89	x	0.63	x	0.7	=	67.26	(78)
South	0.9x 0.77	x	2.16	x	101.89	x	0.63	x	0.7	=	67.26	(78)
South	0.9x 0.77	x	2.16	x	82.59	x	0.63	x	0.7	=	54.52	(78)
South	0.9x 0.77	x	2.16	x	82.59	x	0.63	x	0.7	=	54.52	(78)
South	0.9x 0.77	x	2.16	x	82.59	x	0.63	x	0.7	=	54.52	(78)
South	0.9x 0.77	x	2.16	x	55.42	x	0.63	x	0.7	=	36.58	(78)
South	0.9x 0.77	x	2.16	x	55.42	x	0.63	x	0.7	=	36.58	(78)
South	0.9x 0.77	x	2.16	x	55.42	x	0.63	x	0.7	=	36.58	(78)
South	0.9x 0.77	x	2.16	x	40.4	x	0.63	x	0.7	=	26.67	(78)
South	0.9x 0.77	x	2.16	x	40.4	x	0.63	x	0.7	=	26.67	(78)
South	0.9x 0.77	x	2.16	x	40.4	x	0.63	x	0.7	=	26.67	(78)
West	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(80)
West	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(80)
West	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(80)

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DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(80)
West	0.9x	0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(80)
West	0.9x	0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(80)
West	0.9x	0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(80)
West	0.9x	0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(80)
West	0.9x	0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(80)
West	0.9x	0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(80)
West	0.9x	0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(80)
West	0.9x	0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(80)
West	0.9x	0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(80)
West	0.9x	0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(80)
West	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(80)
West	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(80)
West	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(80)
West	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(80)
West	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(80)
West	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(80)
West	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(80)
West	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(80)
West	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(80)
West	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(80)

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

(83)m=	138.44	241.34	340.89	433.77	491.55	489.24	471.25	428.79	373.59	270	166.93	117.71	(83)

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

(84)m=	548.3	649.12	735.39	806.87	842.94	819.7	788.11	751.56	707.36	625.37	547.12	516.51	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.95	0.9	0.8	0.65	0.48	0.35	0.38	0.59	0.84	0.96	0.98	(86)

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

(87)m=	19.98	20.21	20.5	20.77	20.93	20.99	21	21	20.97	20.76	20.33	19.94	(87)

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

(88)m=	20.22	20.23	20.23	20.24	20.24	20.25	20.25	20.26	20.25	20.24	20.24	20.23	(88)

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

(89)m=	0.97	0.94	0.89	0.77	0.61	0.42	0.29	0.32	0.53	0.81	0.95	0.98	(89)

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

(90)m=	18.86	19.2	19.59	19.98	20.17	20.24	20.25	20.26	20.22	19.96	19.37	18.81	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

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(92)m=	19.25	19.55	19.9	20.25	20.43	20.5	20.51	20.51	20.48	20.24	19.7	19.2	(92)

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

(93)m=	19.25	19.55	19.9	20.25	20.43	20.5	20.51	20.51	20.48	20.24	19.7	19.2	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.94	0.88	0.77	0.62	0.44	0.31	0.34	0.55	0.81	0.94	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	529.68	607.6	647.21	623.75	523.25	362.62	242.81	254.03	387.24	507.88	513.38	502.22	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	973.94	950.89	867.22	721.79	553.25	367.4	243.5	255.08	399.95	610.68	804.01	964.05	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	330.53	230.69	163.68	70.59	22.32	0	0	0	0	76.48	209.25	343.6	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1447.15 (98)

Space heating requirement in kWh/m²/year 18.55 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community boilers 1 (303a)

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

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

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1447.15

Space heat from Community boilers (98) x (304a) x (305) x (306) = 1519.5 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1978.34

If DHW from community scheme:

Water heat from Community boilers (64) x (303a) x (305) x (306) = 2077.25 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 35.97 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

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Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		167.01	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	167.01	(331)
Energy for lighting (calculated in Appendix L)		345.76	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4109.52	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	853.74	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.67	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	872.4	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				872.4	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	86.68	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	179.45	(379)
Total CO2, kg/year	sum of (376)...(382) =				1138.53	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.6	(384)
EI rating (section 14)					87.6	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 13

Address : Flat_13

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78	(1a) x	2.7	(2a) =	210.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.6	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				3 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15 (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) =			0.13 (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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 2			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 3			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 4			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 5			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Walls Type1	56.65	14.12	42.53	x	0.18	=	7.66	70	2977.1	(29)
Walls Type2	13.69	0	13.69	x	0.23	=	3.2	70	958.3	(29)
Walls Type3	21.98	1.89	20.09	x	0.23	=	4.7	70	1406.3	(29)
Total area of elements, m²			92.32							(31)
Party wall			28.38	x	0	=	0	45	1277.1	(32)
Party floor			78					40	3120	(32a)
Party ceiling			78					30	2340	(32b)
Internal wall **			100					9	900	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12978.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 166.39 (35)

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

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 10.32 (36)

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

Total fabric heat loss (33) + (36) = — 47.25 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	19.46	19.24	19.02	17.91	17.69	16.58	16.58	16.36	17.03	17.69	18.13	18.58	(38)

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

(39)m=	66.71	66.49	66.27	65.16	64.94	63.83	63.83	63.61	64.27	64.94	65.38	65.82	

Average = Sum(39)$_{1...12}$ /12= 65.1 (39)

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

(40)m=	0.86	0.85	0.85	0.84	0.83	0.82	0.82	0.82	0.82	0.83	0.84	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 91.77 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	100.94	97.27	93.6	89.93	86.26	82.59	82.59	86.26	89.93	93.6	97.27	100.94	

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

Total = Sum(44)$_{1...12}$ = 1101.19 (44)

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

(45)m=	149.69	130.92	135.1	117.78	113.02	97.53	90.37	103.7	104.94	122.3	133.5	144.97	

Total = Sum(45)$_{1...12}$ = 1443.83 (45)

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

(46)m=	22.45	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.34	20.02	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.19 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.71 (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0 (54)
Enter (50) or (54) in (55)		0.71 (55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	195.09	171.93	180.5	161.72	158.41	141.46	135.77	149.1	148.87	167.7	177.43	190.37	(62)

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

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

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

Output from water heater

(64)m=	195.09	171.93	180.5	161.72	158.41	141.46	135.77	149.1	148.87	167.7	177.43	190.37	

Output from water heater (annual)$_{1...12}$ 1978.34 (64)

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

(65)m=	86.09	76.33	81.24	74.31	73.9	67.57	66.37	70.8	70.04	76.98	79.53	84.52	(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=	121.19	121.19	121.19	121.19	121.19	121.19	121.19	121.19	121.19	121.19	121.19	121.19	(66)

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

(67)m=	19.58	17.39	14.14	10.71	8	6.76	7.3	9.49	12.74	16.17	18.88	20.12	(67)

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

(68)m=	215.21	217.44	211.82	199.83	184.71	170.5	161	158.77	164.4	176.38	191.5	205.71	(68)

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

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	-96.95	(71)

Water heating gains (Table 5)

(72)m=	115.71	113.59	109.19	103.21	99.32	93.85	89.2	95.16	97.28	103.47	110.46	113.6	(72)

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

(73)m=	409.86	407.78	394.51	373.11	351.39	330.46	316.86	322.78	333.77	355.38	380.2	398.8	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.16	x	10.63	x	0.63	x	0.7	=	7.02	(74)
North	0.9x 0.77	x	2.16	x	10.63	x	0.63	x	0.7	=	7.02	(74)
North	0.9x 0.77	x	2.16	x	10.63	x	0.63	x	0.7	=	7.02	(74)
North	0.9x 0.77	x	2.16	x	20.32	x	0.63	x	0.7	=	13.41	(74)
North	0.9x 0.77	x	2.16	x	20.32	x	0.63	x	0.7	=	13.41	(74)
North	0.9x 0.77	x	2.16	x	20.32	x	0.63	x	0.7	=	13.41	(74)
North	0.9x 0.77	x	2.16	x	34.53	x	0.63	x	0.7	=	22.79	(74)
North	0.9x 0.77	x	2.16	x	34.53	x	0.63	x	0.7	=	22.79	(74)
North	0.9x 0.77	x	2.16	x	34.53	x	0.63	x	0.7	=	22.79	(74)
North	0.9x 0.77	x	2.16	x	55.46	x	0.63	x	0.7	=	36.61	(74)
North	0.9x 0.77	x	2.16	x	55.46	x	0.63	x	0.7	=	36.61	(74)
North	0.9x 0.77	x	2.16	x	55.46	x	0.63	x	0.7	=	36.61	(74)
North	0.9x 0.77	x	2.16	x	74.72	x	0.63	x	0.7	=	49.32	(74)
North	0.9x 0.77	x	2.16	x	74.72	x	0.63	x	0.7	=	49.32	(74)
North	0.9x 0.77	x	2.16	x	74.72	x	0.63	x	0.7	=	49.32	(74)
North	0.9x 0.77	x	2.16	x	79.99	x	0.63	x	0.7	=	52.8	(74)
North	0.9x 0.77	x	2.16	x	79.99	x	0.63	x	0.7	=	52.8	(74)
North	0.9x 0.77	x	2.16	x	79.99	x	0.63	x	0.7	=	52.8	(74)
North	0.9x 0.77	x	2.16	x	74.68	x	0.63	x	0.7	=	49.3	(74)
North	0.9x 0.77	x	2.16	x	74.68	x	0.63	x	0.7	=	49.3	(74)
North	0.9x 0.77	x	2.16	x	74.68	x	0.63	x	0.7	=	49.3	(74)
North	0.9x 0.77	x	2.16	x	59.25	x	0.63	x	0.7	=	39.11	(74)
North	0.9x 0.77	x	2.16	x	59.25	x	0.63	x	0.7	=	39.11	(74)
North	0.9x 0.77	x	2.16	x	59.25	x	0.63	x	0.7	=	39.11	(74)
North	0.9x 0.77	x	2.16	x	41.52	x	0.63	x	0.7	=	27.41	(74)
North	0.9x 0.77	x	2.16	x	41.52	x	0.63	x	0.7	=	27.41	(74)
North	0.9x 0.77	x	2.16	x	41.52	x	0.63	x	0.7	=	27.41	(74)
North	0.9x 0.77	x	2.16	x	24.19	x	0.63	x	0.7	=	15.97	(74)
North	0.9x 0.77	x	2.16	x	24.19	x	0.63	x	0.7	=	15.97	(74)
North	0.9x 0.77	x	2.16	x	24.19	x	0.63	x	0.7	=	15.97	(74)
North	0.9x 0.77	x	2.16	x	13.12	x	0.63	x	0.7	=	8.66	(74)
North	0.9x 0.77	x	2.16	x	13.12	x	0.63	x	0.7	=	8.66	(74)
North	0.9x 0.77	x	2.16	x	13.12	x	0.63	x	0.7	=	8.66	(74)
North	0.9x 0.77	x	2.16	x	8.86	x	0.63	x	0.7	=	5.85	(74)
North	0.9x 0.77	x	2.16	x	8.86	x	0.63	x	0.7	=	5.85	(74)
North	0.9x 0.77	x	2.16	x	8.86	x	0.63	x	0.7	=	5.85	(74)
West	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(80)
West	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(80)
West	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(80)

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West	0.9x	0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(80)
West	0.9x	0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(80)
West	0.9x	0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(80)
West	0.9x	0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(80)
West	0.9x	0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(80)
West	0.9x	0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(80)
West	0.9x	0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(80)
West	0.9x	0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(80)
West	0.9x	0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(80)
West	0.9x	0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(80)
West	0.9x	0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(80)
West	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(80)
West	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(80)
West	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(80)
West	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(80)
West	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(80)
West	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(80)
West	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(80)
West	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(80)
West	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(80)
West	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(80)

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

(83)m=	66.92	129.95	216.12	325.3	412.02	428.71	405.23	338.39	254.04	154.35	83.16	55.27	(83)

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

(84)m=	476.77	537.73	610.62	698.41	763.42	759.17	722.1	661.16	587.81	509.73	463.35	454.06	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.72	0.52	0.39	0.44	0.69	0.92	0.98	0.99	(86)

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

(87)m=	19.87	20.04	20.33	20.68	20.9	20.98	21	20.99	20.94	20.63	20.19	19.84	(87)

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

(88)m=	20.21	20.21	20.21	20.22	20.23	20.24	20.24	20.24	20.23	20.23	20.22	20.22	(88)

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

(89)m=	0.99	0.97	0.94	0.85	0.67	0.47	0.32	0.37	0.63	0.9	0.97	0.99	(89)

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

(90)m=	18.68	18.93	19.35	19.84	20.12	20.22	20.24	20.24	20.18	19.79	19.16	18.65	(90)

fLA = Living area ÷ (4) = 0.36 (91)

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

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(92)m=	19.1	19.33	19.7	20.14	20.4	20.5	20.51	20.51	20.45	20.09	19.53	19.07	(92)

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

(93)m=	19.1	19.33	19.7	20.14	20.4	20.5	20.51	20.51	20.45	20.09	19.53	19.07	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.93	0.84	0.68	0.49	0.34	0.39	0.65	0.89	0.97	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	467.99	520.73	570.34	588.94	521.49	369.5	248.46	259.45	382.83	455.14	448.35	447.14	(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=	987.55	959.29	874.65	732.5	564.98	376.31	249.5	261.33	408.06	616.34	812.86	979.02	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	386.55	294.71	226.41	103.36	32.35	0	0	0	0	119.94	262.45	395.72	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1821.48	(98)
Space heating requirement in kWh/m²/year	23.35	(99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community boilers	1	(303a)
Fraction of total space heat from Community boilers (302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1821.48	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1912.56	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		1978.34	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2077.25	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	39.9	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

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Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		167.01	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	167.01	(331)
Energy for lighting (calculated in Appendix L)		345.76	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4502.58	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	947.03	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.71	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	967.74	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				967.74	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	86.68	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	179.45	(379)
Total CO2, kg/year	sum of (376)...(382) =				1233.86	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.82	(384)
EI rating (section 14)					86.56	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 14

Address : Flat_14

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	112	(1a) x	2.7	(2a) =	302.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	112	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		302.4	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				3 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15 (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) =			0.13 (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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 2			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 5			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 6			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 7			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Walls Type1	72.06	16.84	55.22	x	0.18	=	9.94	70	3865.4	(29)
Walls Type2	5.1	1.89	3.21	x	0.23	=	0.75	70	224.7	(29)
Total area of elements, m²			77.16							(31)
Party wall			52.11	x	0	=	0	45	2344.95	(32)
Party floor			112					40	4480	(32a)
Party ceiling			112					30	3360	(32b)
Internal wall **			100					9	900	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.66 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 15175.05 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 135.49 (35)

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

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 11.64 (36)

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

Total fabric heat loss (33) + (36) = 47.3 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.95	27.63	27.31	25.72	25.4	23.81	23.81	23.49	24.45	25.4	26.04	26.68	(38)

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

(39)m=	75.25	74.93	74.61	73.02	72.7	71.11	71.11	70.79	71.75	72.7	73.34	73.97	

Average = Sum(39)$_{1...12}$ /12= 72.94 (39)

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

(40)m=	0.67	0.67	0.67	0.65	0.65	0.63	0.63	0.63	0.64	0.65	0.65	0.66	

Average = Sum(40)$_{1...12}$ /12= 0.65 (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 — 2.83 (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 — 101.32 (43)

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

	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=	111.46	107.4	103.35	99.3	95.25	91.19	91.19	95.25	99.3	103.35	107.4	111.46	

Total = Sum(44)$_{1...12}$ = 1215.9 (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=	165.29	144.56	149.18	130.05	124.79	107.68	99.79	114.51	115.87	135.04	147.41	160.07	

Total = Sum(45)$_{1...12}$ = 1594.24 (45)

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

(46)m=	24.79	21.68	22.38	19.51	18.72	16.15	14.97	17.18	17.38	20.26	22.11	24.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.19 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0 (54)
Enter (50) or (54) in (55)		0.71 (55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	210.68	185.57	194.57	173.99	170.19	151.62	145.18	159.9	159.8	180.44	191.34	205.47	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	210.68	185.57	194.57	173.99	170.19	151.62	145.18	159.9	159.8	180.44	191.34	205.47	

Output from water heater (annual)$_{1...12}$ 2128.74 (64)

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

(65)m=	91.28	80.87	85.92	78.39	77.81	70.95	69.5	74.39	73.67	81.22	84.16	89.54	(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=	141.32	141.32	141.32	141.32	141.32	141.32	141.32	141.32	141.32	141.32	141.32	141.32	(66)

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

(67)m=	25.85	22.96	18.67	14.13	10.57	8.92	9.64	12.53	16.82	21.35	24.92	26.57	(67)

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

(68)m=	274.4	277.25	270.07	254.8	235.51	217.39	205.28	202.44	209.61	224.89	244.17	262.29	(68)

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

(69)m=	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-113.05	-113.05	-113.05	-113.05	-113.05	-113.05	-113.05	-113.05	-113.05	-113.05	-113.05	-113.05	(71)

Water heating gains (Table 5)

(72)m=	122.68	120.34	115.48	108.87	104.58	98.54	93.41	99.99	102.32	109.16	116.89	120.35	(72)

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

(73)m=	488.32	485.94	469.62	443.2	416.06	390.25	373.72	380.34	394.14	420.79	451.37	474.6	(73)

6. Solar gains:

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

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DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.16	x	10.63	x	0.63	x	0.7	=	7.02	(74)
North	0.9x 0.77	x	3.82	x	10.63	x	0.63	x	0.7	=	12.41	(74)
North	0.9x 0.77	x	3.82	x	10.63	x	0.63	x	0.7	=	12.41	(74)
North	0.9x 0.77	x	2.16	x	20.32	x	0.63	x	0.7	=	13.41	(74)
North	0.9x 0.77	x	3.82	x	20.32	x	0.63	x	0.7	=	23.72	(74)
North	0.9x 0.77	x	3.82	x	20.32	x	0.63	x	0.7	=	23.72	(74)
North	0.9x 0.77	x	2.16	x	34.53	x	0.63	x	0.7	=	22.79	(74)
North	0.9x 0.77	x	3.82	x	34.53	x	0.63	x	0.7	=	40.31	(74)
North	0.9x 0.77	x	3.82	x	34.53	x	0.63	x	0.7	=	40.31	(74)
North	0.9x 0.77	x	2.16	x	55.46	x	0.63	x	0.7	=	36.61	(74)
North	0.9x 0.77	x	3.82	x	55.46	x	0.63	x	0.7	=	64.75	(74)
North	0.9x 0.77	x	3.82	x	55.46	x	0.63	x	0.7	=	64.75	(74)
North	0.9x 0.77	x	2.16	x	74.72	x	0.63	x	0.7	=	49.32	(74)
North	0.9x 0.77	x	3.82	x	74.72	x	0.63	x	0.7	=	87.23	(74)
North	0.9x 0.77	x	3.82	x	74.72	x	0.63	x	0.7	=	87.23	(74)
North	0.9x 0.77	x	2.16	x	79.99	x	0.63	x	0.7	=	52.8	(74)
North	0.9x 0.77	x	3.82	x	79.99	x	0.63	x	0.7	=	93.38	(74)
North	0.9x 0.77	x	3.82	x	79.99	x	0.63	x	0.7	=	93.38	(74)
North	0.9x 0.77	x	2.16	x	74.68	x	0.63	x	0.7	=	49.3	(74)
North	0.9x 0.77	x	3.82	x	74.68	x	0.63	x	0.7	=	87.18	(74)
North	0.9x 0.77	x	3.82	x	74.68	x	0.63	x	0.7	=	87.18	(74)
North	0.9x 0.77	x	2.16	x	59.25	x	0.63	x	0.7	=	39.11	(74)
North	0.9x 0.77	x	3.82	x	59.25	x	0.63	x	0.7	=	69.17	(74)
North	0.9x 0.77	x	3.82	x	59.25	x	0.63	x	0.7	=	69.17	(74)
North	0.9x 0.77	x	2.16	x	41.52	x	0.63	x	0.7	=	27.41	(74)
North	0.9x 0.77	x	3.82	x	41.52	x	0.63	x	0.7	=	48.47	(74)
North	0.9x 0.77	x	3.82	x	41.52	x	0.63	x	0.7	=	48.47	(74)
North	0.9x 0.77	x	2.16	x	24.19	x	0.63	x	0.7	=	15.97	(74)
North	0.9x 0.77	x	3.82	x	24.19	x	0.63	x	0.7	=	28.24	(74)
North	0.9x 0.77	x	3.82	x	24.19	x	0.63	x	0.7	=	28.24	(74)
North	0.9x 0.77	x	2.16	x	13.12	x	0.63	x	0.7	=	8.66	(74)
North	0.9x 0.77	x	3.82	x	13.12	x	0.63	x	0.7	=	15.31	(74)
North	0.9x 0.77	x	3.82	x	13.12	x	0.63	x	0.7	=	15.31	(74)
North	0.9x 0.77	x	2.16	x	8.86	x	0.63	x	0.7	=	5.85	(74)
North	0.9x 0.77	x	3.82	x	8.86	x	0.63	x	0.7	=	10.35	(74)
North	0.9x 0.77	x	3.82	x	8.86	x	0.63	x	0.7	=	10.35	(74)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)

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DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x	0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x	0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x	0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x	0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x	0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x	0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x	0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x	0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x	0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x	0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x	0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x	0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x	0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x	0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x	0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x	0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)

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South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)
South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)
South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)
South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	132.43	225.6	313.26	403.29	470.92	477.4	456.05	403.13	343.55	250.13	158.52	113.47	(83)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	620.76	711.54	782.88	846.48	886.98	867.65	829.77	783.47	737.7	670.93	609.89	588.07	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.93	0.85	0.7	0.51	0.38	0.41	0.64	0.88	0.96	0.99	(86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	20.01	20.21	20.46	20.74	20.92	20.99	21	21	20.96	20.74	20.34	19.99	(87)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.37	20.37	20.37	20.38	20.39	20.4	20.4	20.4	20.39	20.39	20.38	20.38	(88)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.98	0.96	0.92	0.83	0.67	0.47	0.32	0.36	0.59	0.85	0.96	0.98	(89)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	19.03	19.31	19.67	20.07	20.3	20.39	20.4	20.4	20.36	20.07	19.51	18.99	(90)

fLA = Living area ÷ (4) = 0.31 (91)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.33	19.59	19.91	20.28	20.49	20.57	20.58	20.59	20.55	20.28	19.77	19.3	(92)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.33	19.59	19.91	20.28	20.49	20.57	20.58	20.59	20.55	20.28	19.77	19.3	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.97	0.95	0.91	0.82	0.67	0.48	0.34	0.38	0.6	0.85	0.95	0.98	(94)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	603.88	677.05	713.08	695.18	596.59	418.39	282.45	294.82	443.9	569.46	579.89	574.94	(95)

Monthly average external temperature from Table 8

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1131.28	1100.5	1000.89	830.95	639.03	424.8	283.36	296.29	462.43	703.88	929.02	1117.18	(97)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	392.39	284.56	214.13	97.76	31.58	0	0	0	0	100.01	251.37	403.42	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1775.23 (98)

Space heating requirement in kWh/m²/year 15.85 (99)

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9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1775.23	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1863.99	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2128.74	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2235.18	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.99	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		239.8	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	239.8	(331)
Energy for lighting (calculated in Appendix L)		456.46	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4795.43	(338)

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12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	972.99	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.27	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	994.26	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)

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Total CO2 associated with space and water heating	(373) + (374) + (375) =			994.26	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	124.46	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	236.9	(379)
Total CO2, kg/year	sum of (376)…(382) =			1355.62	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			12.1	(384)
EI rating (section 14)				88.43	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 15

Address : Flat_15

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54	(1a) x	2.7	(2a) =	145.8	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145.8	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 2			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Walls Type1	35.45	9.5	25.95	x	0.18	=	4.67	70	1816.5	(29)
Walls Type2	19.79	0	19.79	x	0.23	=	4.63	70	1385.3	(29)
Walls Type3	6.94	1.89	5.05	x	0.23	=	1.18	70	353.5	(29)
Total area of elements, m²			62.18							(31)
Party wall			23.14	x	0	=	0	45	1041.3	(32)
Party floor			54					40	2160	(32a)
Party ceiling			54					30	1620	(32b)
Internal wall **			60					9	540	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.72 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8916.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 165.12 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 7.29 (36)

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

Total fabric heat loss (33) + (36) = 33.01 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	13.47	13.32	13.17	12.4	12.25	11.48	11.48	11.33	11.79	12.25	12.55	12.86	(38)

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

(39)m=	46.49	46.33	46.18	45.41	45.26	44.49	44.49	44.34	44.8	45.26	45.57	45.87	

Average = Sum(39)$_{1...12}$ /12= 45.38 (39)

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

(40)m=	0.86	0.86	0.86	0.84	0.84	0.82	0.82	0.82	0.83	0.84	0.84	0.85	

Average = Sum(40)$_{1...12}$ /12= 0.84 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.81 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.14 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.85	81.77	78.68	75.6	72.51	69.43	69.43	72.51	75.6	78.68	81.77	84.85	

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

Total = Sum(44)$_{1...12}$ = 925.68 (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=	125.84	110.06	113.57	99.01	95	81.98	75.97	87.17	88.22	102.81	112.22	121.87	

Total = Sum(45)$_{1...12}$ = 1213.71 (45)

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

(46)m=	18.88	16.51	17.04	14.85	14.25	12.3	11.4	13.08	13.23	15.42	16.83	18.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.19 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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) 0.71 (55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	171.23	151.06	158.97	142.94	140.4	125.91	121.36	132.57	132.15	148.2	156.15	167.26	(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=	171.23	151.06	158.97	142.94	140.4	125.91	121.36	132.57	132.15	148.2	156.15	167.26	

Output from water heater (annual)$_{1,12}$ | 1748.22 | (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=	78.16	69.4	74.08	68.07	67.91	62.4	61.58	65.3	64.48	70.5	72.46	76.84	(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=	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	(66)

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

(67)m=	14.4	12.79	10.4	7.88	5.89	4.97	5.37	6.98	9.37	11.9	13.89	14.81	(67)

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

(68)m=	157.6	159.24	155.12	146.35	135.27	124.86	117.91	116.27	120.39	129.17	140.24	150.65	(68)

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

(69)m=	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	(71)

Water heating gains (Table 5)

(72)m=	105.05	103.27	99.57	94.54	91.27	86.67	82.76	87.77	89.55	94.76	100.64	103.28	(72)

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

(73)m=	327.18	325.42	315.21	298.88	282.55	266.63	256.16	261.15	269.44	285.94	304.89	318.85	(73)

6. Solar gains:

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

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DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(76)
East	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(76)
East	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(76)
East	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(76)
East	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(76)
East	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(76)
East	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(76)
East	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(76)
East	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(76)
East	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(76)
East	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(76)
East	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(76)
East	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(76)
East	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(76)
East	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(76)
East	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(76)
East	0.9x 0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(76)
East	0.9x 0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(76)
East	0.9x 0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(76)
East	0.9x 0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(76)
East	0.9x 0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(76)
East	0.9x 0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(76)
East	0.9x 0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(76)
East	0.9x 0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(76)
West	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(80)
West	0.9x 0.77	x	2.16	x	19.64	x	0.63	x	0.7	=	12.97	(80)
West	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(80)
West	0.9x 0.77	x	2.16	x	38.42	x	0.63	x	0.7	=	25.36	(80)
West	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(80)
West	0.9x 0.77	x	2.16	x	63.27	x	0.63	x	0.7	=	41.77	(80)
West	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(80)
West	0.9x 0.77	x	2.16	x	92.28	x	0.63	x	0.7	=	60.92	(80)
West	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(80)
West	0.9x 0.77	x	2.16	x	113.09	x	0.63	x	0.7	=	74.66	(80)
West	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(80)
West	0.9x 0.77	x	2.16	x	115.77	x	0.63	x	0.7	=	76.42	(80)
West	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(80)
West	0.9x 0.77	x	2.16	x	110.22	x	0.63	x	0.7	=	72.76	(80)
West	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(80)

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West	0.9x	0.77	x	2.16	x	94.68	x	0.63	x	0.7	=	62.5		(80)
West	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91		(80)
West	0.9x	0.77	x	2.16	x	73.59	x	0.63	x	0.7	=	48.58		(80)
West	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22		(80)
West	0.9x	0.77	x	2.16	x	45.59	x	0.63	x	0.7	=	30.09		(80)
West	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59		(80)
West	0.9x	0.77	x	2.16	x	24.49	x	0.63	x	0.7	=	16.17		(80)
West	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86		(80)
West	0.9x	0.77	x	2.16	x	16.15	x	0.63	x	0.7	=	10.66		(80)

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

(83)m=	57.02	111.55	183.7	267.92	328.34	336.12	320	274.87	213.65	132.36	71.1	46.89	(83)

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

(84)m=	384.2	436.97	498.91	566.8	610.89	602.74	576.16	536.02	483.09	418.3	375.99	365.74	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.92	0.81	0.65	0.47	0.34	0.38	0.61	0.87	0.96	0.98	(86)

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

(87)m=	19.97	20.17	20.46	20.77	20.93	20.99	21	21	20.96	20.72	20.3	19.94	(87)

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

(88)m=	20.2	20.2	20.21	20.22	20.22	20.23	20.23	20.24	20.23	20.22	20.22	20.21	(88)

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

(89)m=	0.97	0.95	0.9	0.78	0.6	0.41	0.28	0.32	0.55	0.84	0.95	0.98	(89)

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

(90)m=	18.83	19.11	19.52	19.95	20.15	20.22	20.23	20.23	20.19	19.9	19.31	18.79	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	19.36	19.6	19.95	20.33	20.51	20.58	20.59	20.59	20.55	20.28	19.77	19.33	(92)

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

(93)m=	19.36	19.6	19.95	20.33	20.51	20.58	20.59	20.59	20.55	20.28	19.77	19.33	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.95	0.9	0.78	0.62	0.44	0.31	0.34	0.58	0.84	0.95	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	372.5	414.39	447.88	444.63	377.91	262.8	176.89	184.82	277.91	352.01	356.16	356.39	(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=	700.18	680.99	621.31	518.92	398.89	265.97	177.37	185.64	288.95	438.2	577.36	693.91	(97)

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

(98)m=	243.79	179.16	129.03	53.49	15.61	0	0	0	0	64.12	159.26	251.11

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1095.58 (98)

Space heating requirement in kWh/m²/year 20.29 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community boilers 1 (303a)

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

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

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1095.58

Space heat from Community boilers (98) x (304a) x (305) x (306) = 1150.36 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1748.22

If DHW from community scheme:

Water heat from Community boilers (64) x (303a) x (305) x (306) = 1835.63 (310a)

Electricity used for heat distribution 0.01 × [(307a)...(307e) + (310a)...(310e)] = 29.86 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside 115.62 (330a)

warm air heating system fans 0 (330b)

pump for solar water heating 0 (330g)

Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 115.62 (331)

Energy for lighting (calculated in Appendix L) 254.39 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 3356 (338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel 91 (367a)

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CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	708.76	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	15.5	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	724.26	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			724.26	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	60.01	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	132.03	(379)
Total CO2, kg/year	sum of (376)…(382) =			916.3	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.97	(384)
EI rating (section 14)				87.6	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 16

Address : Flat_16

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54 (1a)	x	2.37 (2a)	=	127.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		127.98	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 2			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Walls Type1	35.48	9.5	25.98	x	0.18	=	4.68	70	1818.6	(29)
Walls Type2	19.82	0	19.82	x	0.23	=	4.64	70	1387.4	(29)
Walls Type3	6.94	1.89	5.05	x	0.23	=	1.18	70	353.5	(29)
Total area of elements, m²			62.24							(31)
Party wall			23.14	x	0	=	0	45	1041.3	(32)
Party floor			54					40	2160	(32a)
Party ceiling			54					30	1620	(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.73 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8380.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 155.2 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 7.3 (36)

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

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Total fabric heat loss (33) + (36) = 33.03 (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=	11.83	11.69	11.56	10.89	10.75	10.08	10.08	9.94	10.35	10.75	11.02	11.29	(38)

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

(39)m=	44.86	44.72	44.59	43.91	43.78	43.11	43.11	42.97	43.38	43.78	44.05	44.32	

Average = Sum(39)$_{1...12}$ /12= 43.88 (39)

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

(40)m=	0.83	0.83	0.83	0.81	0.81	0.8	0.8	0.8	0.8	0.81	0.82	0.82	

Average = Sum(40)$_{1...12}$ /12= 0.81 (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 1.81 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.14 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.85	81.77	78.68	75.6	72.51	69.43	69.43	72.51	75.6	78.68	81.77	84.85	

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

Total = Sum(44)$_{1...12}$ = 925.68 (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=	125.84	110.06	113.57	99.01	95	81.98	75.97	87.17	88.22	102.81	112.22	121.87	

Total = Sum(45)$_{1...12}$ = 1213.71 (45)

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

(46)m=	18.88	16.51	17.04	14.85	14.25	12.3	11.4	13.08	13.23	15.42	16.83	18.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.19 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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) 0.71 (55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	171.23	151.06	158.97	142.94	140.4	125.91	121.36	132.57	132.15	148.2	156.15	167.26	(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=	171.23	151.06	158.97	142.94	140.4	125.91	121.36	132.57	132.15	148.2	156.15	167.26	

Output from water heater (annual)$_{1,12}$ | 1748.22 | (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=	78.16	69.4	74.08	68.07	67.91	62.4	61.58	65.3	64.48	70.5	72.46	76.84	(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=	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	(66)

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

(67)m=	14.4	12.79	10.4	7.88	5.89	4.97	5.37	6.98	9.37	11.9	13.89	14.81	(67)

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

(68)m=	157.6	159.24	155.12	146.35	135.27	124.86	117.91	116.27	120.39	129.17	140.24	150.65	(68)

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

(69)m=	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	(71)

Water heating gains (Table 5)

(72)m=	105.05	103.27	99.57	94.54	91.27	86.67	82.76	87.77	89.55	94.76	100.64	103.28	(72)

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

(73)m=	327.18	325.42	315.21	298.88	282.55	266.63	256.16	261.15	269.44	285.94	304.89	318.85	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	2.16	x	19.64	x	0.63	x	0.7	=	12.97	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	2.16	x	38.42	x	0.63	x	0.7	=	25.36	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	2.16	x	63.27	x	0.63	x	0.7	=	41.77	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	2.16	x	92.28	x	0.63	x	0.7	=	60.92	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	2.16	x	113.09	x	0.63	x	0.7	=	74.66	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	2.16	x	115.77	x	0.63	x	0.7	=	76.42	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	2.16	x	110.22	x	0.63	x	0.7	=	72.76	(76)
East	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x 0.77	x	2.16	x	94.68	x	0.63	x	0.7	=	62.5	(76)
East	0.9x 0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x 0.77	x	2.16	x	73.59	x	0.63	x	0.7	=	48.58	(76)
East	0.9x 0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x 0.77	x	2.16	x	45.59	x	0.63	x	0.7	=	30.09	(76)
East	0.9x 0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x 0.77	x	2.16	x	24.49	x	0.63	x	0.7	=	16.17	(76)
East	0.9x 0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
East	0.9x 0.77	x	2.16	x	16.15	x	0.63	x	0.7	=	10.66	(76)
West	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)

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West	0.9x	0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)

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

(83)m=	57.02	111.55	183.7	267.92	328.34	336.12	320	274.87	213.65	132.36	71.1	46.89	(83)

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

(84)m=	384.2	436.97	498.91	566.8	610.89	602.74	576.16	536.02	483.09	418.3	375.99	365.74	(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=	0.97	0.95	0.91	0.79	0.63	0.45	0.33	0.37	0.59	0.85	0.95	0.98	(86)

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

(87)m=	19.99	20.18	20.47	20.78	20.93	20.99	21	21	20.96	20.73	20.31	19.95	(87)

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

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

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

(89)m=	0.97	0.95	0.89	0.76	0.58	0.4	0.27	0.31	0.54	0.82	0.95	0.97	(89)

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

(90)m=	18.87	19.15	19.56	19.98	20.18	20.25	20.25	20.25	20.22	19.93	19.35	18.83	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	19.39	19.63	19.98	20.35	20.53	20.59	20.6	20.6	20.56	20.3	19.79	19.35	(92)

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

(93)m=	19.39	19.63	19.98	20.35	20.53	20.59	20.6	20.6	20.56	20.3	19.79	19.35	(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=	0.96	0.94	0.88	0.77	0.6	0.42	0.3	0.34	0.56	0.83	0.94	0.97	(94)

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

(95)m=	370.27	410.69	441.43	434.73	367.24	255.18	171.88	179.62	270.09	345.48	352.96	354.53	(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=	676.73	658.6	601.21	502.73	386.48	258.19	172.35	180.41	280.32	424.79	559.17	671.27	(97)

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

(98)m=	228.01	166.6	118.88	48.96	14.31	0	0	0	0	59.01	148.47	235.65

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1019.89 (98)

Space heating requirement in kWh/m²/year 18.89 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community boilers 1 (303a)

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

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

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		1019.89	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1070.88	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		1748.22	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1835.63	(310a)
Electricity used for heat distribution	0.01 × [(307a)...(307e) + (310a)...(310e)] =	29.07	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		101.49	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	101.49	(331)
Energy for lighting (calculated in Appendix L)		254.39	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3262.39	(338)

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12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
CO2 from other sources of space and water heating (not CHP)				
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		91	(367a)

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CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	689.9	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	15.08	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	704.98	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			704.98	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	52.67	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	132.03	(379)
Total CO2, kg/year	sum of (376)…(382) =			889.68	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.48	(384)
EI rating (section 14)				87.96	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 17

Address : Flat_17

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	156.23 (1a)	x	2.7 (2a)	=	421.82	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	156.23 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		421.82	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 2			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 3			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 4			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 5			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Walls Type1	56.62	14.12	42.5	x	0.18	=	7.65	70	2975	(29)
Walls Type2	8.1	0	8.1	x	0.23	=	1.89	70	567	(29)
Walls Type3	22.09	1.89	20.2	x	0.23	=	4.72	70	1414	(29)
Total area of elements, m²			86.81							(31)
Party wall			23.73	x	0	=	0	45	1067.85	(32)
Party floor			88					40	3520	(32a)
Party ceiling			88					30	2640	(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) = 35.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12183.85 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 77.99 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 10.04 (36)

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

Total fabric heat loss (33) + (36) = 45.67 (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=	38.98	38.54	38.1	35.88	35.44	33.22	33.22	32.77	34.1	35.44	36.32	37.21	(38)

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

(39)m=	84.66	84.21	83.77	81.55	81.11	78.89	78.89	78.45	79.78	81.11	82	82.88	

Average = Sum(39)$_{1...12}$ /12= 81.44 (39)

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

(40)m=	0.54	0.54	0.54	0.52	0.52	0.5	0.5	0.5	0.51	0.52	0.52	0.53	

Average = Sum(40)$_{1...12}$ /12= 0.52 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.94 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 104.11 (43)

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

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

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

(44)m=	114.52	110.36	106.19	102.03	97.86	93.7	93.7	97.86	102.03	106.19	110.36	114.52	

Total = Sum(44)$_{1...12}$ = 1249.31 (44)

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

(45)m=	169.83	148.53	153.27	133.63	128.22	110.64	102.53	117.65	119.06	138.75	151.46	164.47	

Total = Sum(45)$_{1...12}$ = 1638.04 (45)

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

(46)m=	25.47	22.28	22.99	20.04	19.23	16.6	15.38	17.65	17.86	20.81	22.72	24.67	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.19 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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) 0.71 (55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	215.23	189.54	198.67	177.56	173.62	154.58	147.92	163.05	162.99	184.15	195.39	209.87	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	215.23	189.54	198.67	177.56	173.62	154.58	147.92	163.05	162.99	184.15	195.39	209.87	

Output from water heater (annual)$_{1,12}$ | 2172.54 | (64)

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

(65)m=	92.79	82.19	87.28	79.58	78.95	71.93	70.41	75.44	74.73	82.45	85.5	91	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	147.18	147.18	147.18	147.18	147.18	147.18	147.18	147.18	147.18	147.18	147.18	147.18	(66)

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

(67)m=	34.39	30.55	24.84	18.81	14.06	11.87	12.82	16.67	22.37	28.41	33.16	35.35	(67)

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

(68)m=	327.22	330.62	322.06	303.84	280.85	259.24	244.8	241.4	249.96	268.18	291.17	312.78	(68)

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

(69)m=	37.72	37.72	37.72	37.72	37.72	37.72	37.72	37.72	37.72	37.72	37.72	37.72	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-117.74	-117.74	-117.74	-117.74	-117.74	-117.74	-117.74	-117.74	-117.74	-117.74	-117.74	-117.74	(71)

Water heating gains (Table 5)

(72)m=	124.71	122.31	117.31	110.52	106.12	99.91	94.63	101.39	103.79	110.82	118.76	122.32	(72)

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

(73)m=	553.48	550.62	531.37	500.33	468.18	438.17	419.41	426.62	443.28	474.56	510.24	537.6	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.16	x	10.63	x	0.63	x	0.7	=	7.02	(74)
North	0.9x 0.77	x	2.16	x	10.63	x	0.63	x	0.7	=	7.02	(74)
North	0.9x 0.77	x	2.16	x	10.63	x	0.63	x	0.7	=	7.02	(74)
North	0.9x 0.77	x	2.16	x	20.32	x	0.63	x	0.7	=	13.41	(74)
North	0.9x 0.77	x	2.16	x	20.32	x	0.63	x	0.7	=	13.41	(74)
North	0.9x 0.77	x	2.16	x	20.32	x	0.63	x	0.7	=	13.41	(74)
North	0.9x 0.77	x	2.16	x	34.53	x	0.63	x	0.7	=	22.79	(74)
North	0.9x 0.77	x	2.16	x	34.53	x	0.63	x	0.7	=	22.79	(74)
North	0.9x 0.77	x	2.16	x	34.53	x	0.63	x	0.7	=	22.79	(74)
North	0.9x 0.77	x	2.16	x	55.46	x	0.63	x	0.7	=	36.61	(74)
North	0.9x 0.77	x	2.16	x	55.46	x	0.63	x	0.7	=	36.61	(74)
North	0.9x 0.77	x	2.16	x	55.46	x	0.63	x	0.7	=	36.61	(74)
North	0.9x 0.77	x	2.16	x	74.72	x	0.63	x	0.7	=	49.32	(74)
North	0.9x 0.77	x	2.16	x	74.72	x	0.63	x	0.7	=	49.32	(74)
North	0.9x 0.77	x	2.16	x	74.72	x	0.63	x	0.7	=	49.32	(74)
North	0.9x 0.77	x	2.16	x	79.99	x	0.63	x	0.7	=	52.8	(74)
North	0.9x 0.77	x	2.16	x	79.99	x	0.63	x	0.7	=	52.8	(74)
North	0.9x 0.77	x	2.16	x	79.99	x	0.63	x	0.7	=	52.8	(74)
North	0.9x 0.77	x	2.16	x	74.68	x	0.63	x	0.7	=	49.3	(74)
North	0.9x 0.77	x	2.16	x	74.68	x	0.63	x	0.7	=	49.3	(74)
North	0.9x 0.77	x	2.16	x	74.68	x	0.63	x	0.7	=	49.3	(74)
North	0.9x 0.77	x	2.16	x	59.25	x	0.63	x	0.7	=	39.11	(74)
North	0.9x 0.77	x	2.16	x	59.25	x	0.63	x	0.7	=	39.11	(74)
North	0.9x 0.77	x	2.16	x	59.25	x	0.63	x	0.7	=	39.11	(74)
North	0.9x 0.77	x	2.16	x	41.52	x	0.63	x	0.7	=	27.41	(74)
North	0.9x 0.77	x	2.16	x	41.52	x	0.63	x	0.7	=	27.41	(74)
North	0.9x 0.77	x	2.16	x	41.52	x	0.63	x	0.7	=	27.41	(74)
North	0.9x 0.77	x	2.16	x	24.19	x	0.63	x	0.7	=	15.97	(74)
North	0.9x 0.77	x	2.16	x	24.19	x	0.63	x	0.7	=	15.97	(74)
North	0.9x 0.77	x	2.16	x	24.19	x	0.63	x	0.7	=	15.97	(74)
North	0.9x 0.77	x	2.16	x	13.12	x	0.63	x	0.7	=	8.66	(74)
North	0.9x 0.77	x	2.16	x	13.12	x	0.63	x	0.7	=	8.66	(74)
North	0.9x 0.77	x	2.16	x	13.12	x	0.63	x	0.7	=	8.66	(74)
North	0.9x 0.77	x	2.16	x	8.86	x	0.63	x	0.7	=	5.85	(74)
North	0.9x 0.77	x	2.16	x	8.86	x	0.63	x	0.7	=	5.85	(74)
North	0.9x 0.77	x	2.16	x	8.86	x	0.63	x	0.7	=	5.85	(74)
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)

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East	0.9x	0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x	0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x	0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x	0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x	0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x	0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x	0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x	0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x	0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x	0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x	0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
East	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)

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

(83)m=	66.92	129.95	216.12	325.3	412.02	428.71	405.23	338.39	254.04	154.35	83.16	55.27	(83)

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

(84)m=	620.39	680.57	747.49	825.63	880.2	866.88	824.65	765.01	697.32	628.91	593.4	592.87	(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=	0.97	0.96	0.93	0.85	0.73	0.55	0.41	0.46	0.69	0.89	0.96	0.98	(86)

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

(87)m=	19.59	19.77	20.09	20.5	20.8	20.95	20.99	20.98	20.88	20.5	20	19.57	(87)

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

(88)m=	20.48	20.49	20.49	20.5	20.5	20.52	20.52	20.52	20.51	20.5	20.5	20.49	(88)

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

(89)m=	0.97	0.95	0.92	0.84	0.7	0.51	0.37	0.41	0.66	0.88	0.95	0.97	(89)

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

(90)m=	18.52	18.79	19.25	19.85	20.25	20.46	20.5	20.5	20.37	19.85	19.12	18.51	(90)

fLA = Living area ÷ (4) = 0.22 (91)

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

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(92)m=	18.75	19.01	19.44	19.99	20.37	20.57	20.61	20.61	20.48	19.99	19.31	18.74	(92)

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

(93)m=	18.75	19.01	19.44	19.99	20.37	20.57	20.61	20.61	20.48	19.99	19.31	18.74	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.96	0.94	0.9	0.82	0.69	0.52	0.38	0.42	0.65	0.86	0.94	0.96	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	593.91	640.15	676.17	680.91	611.39	449.35	311.46	322.6	456.38	540.36	556.38	570.6	(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=	1223.69	1187.98	1083.6	904.66	703.38	470.85	316.33	329.93	509.15	761.76	1001.5	1205.19	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	468.56	368.14	303.13	161.1	68.44	0	0	0	0	164.72	320.49	472.13	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2326.7	(98)
Space heating requirement in kWh/m²/year	14.89	(99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community boilers	1	(303a)
Fraction of total space heat from Community boilers (302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2326.7	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2443.03	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2172.54	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2281.17	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.24	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

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Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		334.5	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	334.5	(331)
Energy for lighting (calculated in Appendix L)		607.39	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5666.1	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1121.35	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	24.52	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	1145.87	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1145.87	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	173.61	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	315.23	(379)
Total CO2, kg/year	sum of (376)...(382) =				1634.71	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				10.46	(384)
EI rating (section 14)					89.11	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 18

Address : Flat_18

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	88	(1a) x	2.7	(2a) =	237.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	88	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		237.6	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=

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

(24a)

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

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

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

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

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

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

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

(25)m=

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

(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 2			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 3			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 4			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 5			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Walls Type1	56.65	14.12	42.53	x	0.18	=	7.66	70	2977.1	(29)
Walls Type2	13.69	0	13.69	x	0.23	=	3.2	70	958.3	(29)
Walls Type3	21.98	1.89	20.09	x	0.23	=	4.7	70	1406.3	(29)
Total area of elements, m²			92.32							(31)
Party wall			28.38	x	0	=	0	45	1277.1	(32)
Party floor			88					40	3520	(32a)
Party ceiling			88					30	2640	(32b)
Internal wall **			100					9	900	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13678.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 155.44 (35)

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

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 10.32 (36)

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

Total fabric heat loss (33) + (36) = 47.25 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.96	21.71	21.46	20.21	19.96	18.71	18.71	18.46	19.21	19.96	20.46	20.96	(38)

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

(39)m=	69.2	68.95	68.7	67.45	67.21	65.96	65.96	65.71	66.46	67.21	67.7	68.2	

Average = Sum(39)$_{1...12}$ /12= 67.39 (39)

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

(40)m=	0.79	0.78	0.78	0.77	0.76	0.75	0.75	0.75	0.76	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.77 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.6 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 95.89 (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=	105.48	101.64	97.8	93.97	90.13	86.3	86.3	90.13	93.97	97.8	101.64	105.48	

Total = Sum(44)$_{1...12}$ = 1150.64 (44)

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

(45)m=	156.42	136.8	141.17	123.07	118.09	101.91	94.43	108.36	109.65	127.79	139.49	151.48	

Total = Sum(45)$_{1...12}$ = 1508.67 (45)

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

(46)m=	23.46	20.52	21.18	18.46	17.71	15.29	14.16	16.25	16.45	19.17	20.92	22.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.19 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)	0.71	(55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	201.81	177.81	186.57	167.01	163.49	145.84	139.83	153.76	153.59	173.19	183.43	196.88	(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=	201.81	177.81	186.57	167.01	163.49	145.84	139.83	153.76	153.59	173.19	183.43	196.88	

Output from water heater (annual)$_{1...12}$ 2043.18 (64)

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

(65)m=	88.33	78.29	83.26	76.07	75.58	69.03	67.72	72.35	71.61	78.81	81.53	86.68	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.87	129.87	129.87	129.87	129.87	129.87	129.87	129.87	129.87	129.87	129.87	129.87	(66)

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

(67)m=	21.88	19.43	15.8	11.96	8.94	7.55	8.16	10.6	14.23	18.07	21.09	22.49	(67)

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

(68)m=	235.35	237.79	231.64	218.54	202	186.45	176.07	173.63	179.78	192.88	209.42	224.97	(68)

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

(69)m=	35.99	35.99	35.99	35.99	35.99	35.99	35.99	35.99	35.99	35.99	35.99	35.99	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-103.89	-103.89	-103.89	-103.89	-103.89	-103.89	-103.89	-103.89	-103.89	-103.89	-103.89	-103.89	(71)

Water heating gains (Table 5)

(72)m=	118.72	116.5	111.9	105.65	101.59	95.87	91.01	97.24	99.45	105.92	113.23	116.51	(72)

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

(73)m=	437.9	435.69	421.3	398.11	374.49	351.84	337.2	343.43	355.43	378.84	405.71	425.92	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x 0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x 0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x 0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x 0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x 0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x 0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x 0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
East	0.9x 0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
South	0.9x 0.77	x	2.16	x	46.75	x	0.63	x	0.7	=	30.86	(78)
South	0.9x 0.77	x	2.16	x	46.75	x	0.63	x	0.7	=	30.86	(78)
South	0.9x 0.77	x	2.16	x	46.75	x	0.63	x	0.7	=	30.86	(78)
South	0.9x 0.77	x	2.16	x	76.57	x	0.63	x	0.7	=	50.54	(78)
South	0.9x 0.77	x	2.16	x	76.57	x	0.63	x	0.7	=	50.54	(78)
South	0.9x 0.77	x	2.16	x	76.57	x	0.63	x	0.7	=	50.54	(78)
South	0.9x 0.77	x	2.16	x	97.53	x	0.63	x	0.7	=	64.38	(78)
South	0.9x 0.77	x	2.16	x	97.53	x	0.63	x	0.7	=	64.38	(78)
South	0.9x 0.77	x	2.16	x	97.53	x	0.63	x	0.7	=	64.38	(78)
South	0.9x 0.77	x	2.16	x	110.23	x	0.63	x	0.7	=	72.77	(78)
South	0.9x 0.77	x	2.16	x	110.23	x	0.63	x	0.7	=	72.77	(78)
South	0.9x 0.77	x	2.16	x	110.23	x	0.63	x	0.7	=	72.77	(78)
South	0.9x 0.77	x	2.16	x	114.87	x	0.63	x	0.7	=	75.83	(78)
South	0.9x 0.77	x	2.16	x	114.87	x	0.63	x	0.7	=	75.83	(78)
South	0.9x 0.77	x	2.16	x	114.87	x	0.63	x	0.7	=	75.83	(78)

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South	0.9x	0.77	x	2.16	x	110.55	x	0.63	x	0.7	=	72.98	(78)
South	0.9x	0.77	x	2.16	x	110.55	x	0.63	x	0.7	=	72.98	(78)
South	0.9x	0.77	x	2.16	x	110.55	x	0.63	x	0.7	=	72.98	(78)
South	0.9x	0.77	x	2.16	x	108.01	x	0.63	x	0.7	=	71.3	(78)
South	0.9x	0.77	x	2.16	x	108.01	x	0.63	x	0.7	=	71.3	(78)
South	0.9x	0.77	x	2.16	x	108.01	x	0.63	x	0.7	=	71.3	(78)
South	0.9x	0.77	x	2.16	x	104.89	x	0.63	x	0.7	=	69.24	(78)
South	0.9x	0.77	x	2.16	x	104.89	x	0.63	x	0.7	=	69.24	(78)
South	0.9x	0.77	x	2.16	x	104.89	x	0.63	x	0.7	=	69.24	(78)
South	0.9x	0.77	x	2.16	x	101.89	x	0.63	x	0.7	=	67.26	(78)
South	0.9x	0.77	x	2.16	x	101.89	x	0.63	x	0.7	=	67.26	(78)
South	0.9x	0.77	x	2.16	x	101.89	x	0.63	x	0.7	=	67.26	(78)
South	0.9x	0.77	x	2.16	x	82.59	x	0.63	x	0.7	=	54.52	(78)
South	0.9x	0.77	x	2.16	x	82.59	x	0.63	x	0.7	=	54.52	(78)
South	0.9x	0.77	x	2.16	x	82.59	x	0.63	x	0.7	=	54.52	(78)
South	0.9x	0.77	x	2.16	x	55.42	x	0.63	x	0.7	=	36.58	(78)
South	0.9x	0.77	x	2.16	x	55.42	x	0.63	x	0.7	=	36.58	(78)
South	0.9x	0.77	x	2.16	x	55.42	x	0.63	x	0.7	=	36.58	(78)
South	0.9x	0.77	x	2.16	x	40.4	x	0.63	x	0.7	=	26.67	(78)
South	0.9x	0.77	x	2.16	x	40.4	x	0.63	x	0.7	=	26.67	(78)
South	0.9x	0.77	x	2.16	x	40.4	x	0.63	x	0.7	=	26.67	(78)

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

(83)m=	138.44	241.34	340.89	433.77	491.55	489.24	471.25	428.79	373.59	270	166.93	117.71	(83)

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

(84)m=	576.35	677.03	762.19	831.88	866.04	841.07	808.45	772.22	729.02	648.84	572.63	543.64	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.91	0.82	0.67	0.49	0.36	0.39	0.6	0.86	0.96	0.98	(86)

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

(87)m=	20.01	20.22	20.5	20.77	20.93	20.99	21	21	20.97	20.76	20.34	19.97	(87)

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

(88)m=	20.27	20.27	20.27	20.28	20.28	20.3	20.3	20.3	20.29	20.28	20.28	20.28	(88)

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

(89)m=	0.98	0.95	0.9	0.79	0.63	0.44	0.3	0.33	0.55	0.83	0.95	0.98	(89)

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

(90)m=	18.93	19.24	19.63	20.01	20.21	20.29	20.3	20.3	20.26	20	19.42	18.88	(90)

fLA = Living area ÷ (4) = 0.39 (91)

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

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(92)m=	19.35	19.62	19.96	20.31	20.49	20.56	20.57	20.57	20.53	20.29	19.78	19.3	(92)

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

(93)m=	19.35	19.62	19.96	20.31	20.49	20.56	20.57	20.57	20.53	20.29	19.78	19.3	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.94	0.89	0.79	0.64	0.46	0.32	0.35	0.57	0.83	0.95	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	559.41	639.28	681.08	659.23	556.51	387.6	260.9	272.69	413.41	537.47	541.62	530.68	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1041.25	1015.2	925.03	769.33	590.48	392.92	261.66	273.85	427.63	651.51	858.24	1030.13	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	358.49	252.62	181.5	79.27	25.27	0	0	0	0	84.85	227.97	371.59	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1581.56	(98)
Space heating requirement in kWh/m²/year	17.97	(99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community boilers	1	(303a)
Fraction of total space heat from Community boilers (302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1581.56	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1660.63	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2043.18	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2145.34	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	38.06	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

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Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		188.42	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	188.42	(331)
Energy for lighting (calculated in Appendix L)		386.36	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4380.75	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	903.4	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.75	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	923.15	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				923.15	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	97.79	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	200.52	(379)
Total CO2, kg/year	sum of (376)...(382) =				1221.46	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				13.88	(384)
EI rating (section 14)					87.69	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 19

Address : Flat_19

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54	(1a) x	2.7	(2a) =	145.8	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145.8	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 2			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Walls Type1	35.45	9.5	25.95	x	0.18	=	4.67	70	1816.5	(29)
Walls Type2	19.79	0	19.79	x	0.23	=	4.63	70	1385.3	(29)
Walls Type3	6.94	1.89	5.05	x	0.23	=	1.18	70	353.5	(29)
Total area of elements, m²			62.18							(31)
Party wall			23.14	x	0	=	0	45	1041.3	(32)
Party floor			54					40	2160	(32a)
Party ceiling			54					30	1620	(32b)
Internal wall **			60					9	540	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.72 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8916.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 165.12 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 7.29 (36)

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

Total fabric heat loss (33) + (36) = 33.01 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	13.47	13.32	13.17	12.4	12.25	11.48	11.48	11.33	11.79	12.25	12.55	12.86	(38)

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

(39)m=	46.49	46.33	46.18	45.41	45.26	44.49	44.49	44.34	44.8	45.26	45.57	45.87	

Average = Sum(39)$_{1...12}$ /12= 45.38 (39)

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

(40)m=	0.86	0.86	0.86	0.84	0.84	0.82	0.82	0.82	0.83	0.84	0.84	0.85	

Average = Sum(40)$_{1...12}$ /12= 0.84 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.81 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.14 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.85	81.77	78.68	75.6	72.51	69.43	69.43	72.51	75.6	78.68	81.77	84.85	

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

Total = Sum(44)$_{1...12}$ = 925.68 (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=	125.84	110.06	113.57	99.01	95	81.98	75.97	87.17	88.22	102.81	112.22	121.87	

Total = Sum(45)$_{1...12}$ = 1213.71 (45)

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

(46)m=	18.88	16.51	17.04	14.85	14.25	12.3	11.4	13.08	13.23	15.42	16.83	18.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.19 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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) 0.71 (55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	171.23	151.06	158.97	142.94	140.4	125.91	121.36	132.57	132.15	148.2	156.15	167.26	(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=	171.23	151.06	158.97	142.94	140.4	125.91	121.36	132.57	132.15	148.2	156.15	167.26	

Output from water heater (annual)$_{1,12}$ | 1748.22 | (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=	78.16	69.4	74.08	68.07	67.91	62.4	61.58	65.3	64.48	70.5	72.46	76.84	(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=	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	(66)

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

(67)m=	14.4	12.79	10.4	7.88	5.89	4.97	5.37	6.98	9.37	11.9	13.89	14.81	(67)

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

(68)m=	157.6	159.24	155.12	146.35	135.27	124.86	117.91	116.27	120.39	129.17	140.24	150.65	(68)

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

(69)m=	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	(71)

Water heating gains (Table 5)

(72)m=	105.05	103.27	99.57	94.54	91.27	86.67	82.76	87.77	89.55	94.76	100.64	103.28	(72)

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

(73)m=	327.18	325.42	315.21	298.88	282.55	266.63	256.16	261.15	269.44	285.94	304.89	318.85	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	2.16	x	19.64	x	0.63	x	0.7	=	12.97	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	2.16	x	38.42	x	0.63	x	0.7	=	25.36	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	2.16	x	63.27	x	0.63	x	0.7	=	41.77	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	2.16	x	92.28	x	0.63	x	0.7	=	60.92	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	2.16	x	113.09	x	0.63	x	0.7	=	74.66	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	2.16	x	115.77	x	0.63	x	0.7	=	76.42	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	2.16	x	110.22	x	0.63	x	0.7	=	72.76	(76)
East	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x 0.77	x	2.16	x	94.68	x	0.63	x	0.7	=	62.5	(76)
East	0.9x 0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x 0.77	x	2.16	x	73.59	x	0.63	x	0.7	=	48.58	(76)
East	0.9x 0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x 0.77	x	2.16	x	45.59	x	0.63	x	0.7	=	30.09	(76)
East	0.9x 0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x 0.77	x	2.16	x	24.49	x	0.63	x	0.7	=	16.17	(76)
East	0.9x 0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
East	0.9x 0.77	x	2.16	x	16.15	x	0.63	x	0.7	=	10.66	(76)
West	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)

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West	0.9x	0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)

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

(83)m=	57.02	111.55	183.7	267.92	328.34	336.12	320	274.87	213.65	132.36	71.1	46.89	(83)

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

(84)m=	384.2	436.97	498.91	566.8	610.89	602.74	576.16	536.02	483.09	418.3	375.99	365.74	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.92	0.81	0.65	0.47	0.34	0.38	0.61	0.87	0.96	0.98	(86)

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

(87)m=	19.97	20.17	20.46	20.77	20.93	20.99	21	21	20.96	20.72	20.3	19.94	(87)

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

(88)m=	20.2	20.2	20.21	20.22	20.22	20.23	20.23	20.24	20.23	20.22	20.22	20.21	(88)

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

(89)m=	0.97	0.95	0.9	0.78	0.6	0.41	0.28	0.32	0.55	0.84	0.95	0.98	(89)

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

(90)m=	18.83	19.11	19.52	19.95	20.15	20.22	20.23	20.23	20.19	19.9	19.31	18.79	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	19.36	19.6	19.95	20.33	20.51	20.58	20.59	20.59	20.55	20.28	19.77	19.33	(92)

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

(93)m=	19.36	19.6	19.95	20.33	20.51	20.58	20.59	20.59	20.55	20.28	19.77	19.33	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.97	0.95	0.9	0.78	0.62	0.44	0.31	0.34	0.58	0.84	0.95	0.97	(94)

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

(95)m=	372.5	414.39	447.88	444.63	377.91	262.8	176.89	184.82	277.91	352.01	356.16	356.39	(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=	700.18	680.99	621.31	518.92	398.89	265.97	177.37	185.64	288.95	438.2	577.36	693.91	(97)

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

(98)m=	243.79	179.16	129.03	53.49	15.61	0	0	0	0	64.12	159.26	251.11

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1095.58 (98)

Space heating requirement in kWh/m²/year 20.29 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community boilers 1 (303a)

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

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

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1095.58

Space heat from Community boilers (98) x (304a) x (305) x (306) = 1150.36 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1748.22

If DHW from community scheme:

Water heat from Community boilers (64) x (303a) x (305) x (306) = 1835.63 (310a)

Electricity used for heat distribution 0.01 × [(307a)...(307e) + (310a)...(310e)] = 29.86 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside 115.62 (330a)

warm air heating system fans 0 (330b)

pump for solar water heating 0 (330g)

Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 115.62 (331)

Energy for lighting (calculated in Appendix L) 254.39 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 3356 (338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel 91 (367a)

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CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	708.76	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	15.5	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	724.26	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			724.26	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	60.01	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	132.03	(379)
Total CO2, kg/year	sum of (376)…(382) =			916.3	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.97	(384)
EI rating (section 14)				87.6	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 20

Address : Flat_20

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54.01	(1a) x	2.7	(2a) =	145.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145.83	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 2			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Walls Type1	35.48	9.1	26.38	x	0.18	=	4.75	70	1846.6	(29)
Walls Type2	19.82	0	19.82	x	0.23	=	4.64	70	1387.4	(29)
Walls Type3	6.94	1.89	5.05	x	0.23	=	1.18	70	353.5	(29)
Roof	54.01	0	54.01	x	0.1	=	5.4	9	486.09	(30)
Total area of elements, m²			116.25							(31)
Party wall			23.14	x	0	=	0	45	1041.3	(32)
Party floor			54					40	2160	(32a)
Internal wall **			60					9	540	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.68 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7814.89 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 144.69 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.09 (36)

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

Total fabric heat loss (33) + (36) = 39.76 (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=	13.48	13.32	13.17	12.4	12.25	11.48	11.48	11.33	11.79	12.25	12.56	12.86	(38)

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

(39)m=	53.24	53.09	52.93	52.17	52.01	51.25	51.25	51.09	51.55	52.01	52.32	52.63	

Average = Sum(39)$_{1...12}$ /12= 52.13 (39)

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

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

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.81 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.15 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.86	81.78	78.69	75.6	72.52	69.43	69.43	72.52	75.6	78.69	81.78	84.86	

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

Total = Sum(44)$_{1...12}$ = 925.76 (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=	125.85	110.07	113.58	99.02	95.01	81.99	75.98	87.18	88.22	102.82	112.23	121.88	

Total = Sum(45)$_{1...12}$ = 1213.82 (45)

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

(46)m=	18.88	16.51	17.04	14.85	14.25	12.3	11.4	13.08	13.23	15.42	16.83	18.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.19 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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) 0.71 (55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	171.24	151.07	158.98	142.95	140.41	125.92	121.37	132.58	132.16	148.21	156.16	167.27	(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=	171.24	151.07	158.98	142.95	140.41	125.92	121.37	132.58	132.16	148.21	156.16	167.27	

Output from water heater (annual)$_{1,12}$ | 1748.33 | (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=	78.16	69.4	74.08	68.07	67.91	62.41	61.58	65.31	64.48	70.5	72.46	76.84	(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=	90.41	90.41	90.41	90.41	90.41	90.41	90.41	90.41	90.41	90.41	90.41	90.41	(66)

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

(67)m=	14.52	12.89	10.49	7.94	5.93	5.01	5.41	7.04	9.44	11.99	14	14.92	(67)

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

(68)m=	157.63	159.27	155.14	146.37	135.29	124.88	117.93	116.29	120.41	129.19	140.26	150.68	(68)

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

(69)m=	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	(71)

Water heating gains (Table 5)

(72)m=	105.06	103.27	99.57	94.54	91.28	86.68	82.77	87.78	89.56	94.76	100.64	103.28	(72)

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

(73)m=	327.33	325.56	315.33	298.97	282.63	266.69	256.23	261.23	269.54	286.07	305.03	319	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(76)
East	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(76)
East	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(76)
East	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(76)
East	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(76)
East	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(76)
East	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(76)
East	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(76)
East	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(76)
East	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(76)
East	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(76)
East	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(76)
East	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(76)
East	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(76)
East	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(76)
East	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(76)
East	0.9x 0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(76)
East	0.9x 0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(76)
East	0.9x 0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(76)
East	0.9x 0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(76)
East	0.9x 0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(76)
East	0.9x 0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(76)
East	0.9x 0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(76)
East	0.9x 0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(76)
West	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(80)
West	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(80)
West	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(80)
West	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(80)
West	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(80)
West	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(80)
West	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(80)
West	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)

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West	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)
West	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(80)

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

(83)m=	54.62	106.85	175.97	256.64	314.52	321.97	306.53	263.3	204.66	126.79	68.11	44.92	(83)

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

(84)m=	381.95	432.41	491.3	555.61	597.15	588.66	562.76	524.53	474.19	412.85	373.13	363.92	(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=	0.97	0.96	0.92	0.84	0.7	0.53	0.39	0.44	0.67	0.88	0.96	0.98	(86)

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

(87)m=	19.59	19.8	20.14	20.55	20.82	20.95	20.99	20.98	20.89	20.51	19.99	19.55	(87)

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

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

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

(89)m=	0.97	0.95	0.91	0.81	0.65	0.47	0.32	0.36	0.6	0.86	0.95	0.97	(89)

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

(90)m=	18.21	18.52	19.01	19.57	19.93	20.09	20.12	20.12	20.02	19.54	18.8	18.17	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	18.85	19.11	19.53	20.02	20.34	20.49	20.52	20.52	20.42	19.99	19.35	18.81	(92)

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

(93)m=	18.85	19.11	19.53	20.02	20.34	20.49	20.52	20.52	20.42	19.99	19.35	18.81	(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=	0.96	0.94	0.9	0.81	0.67	0.49	0.35	0.39	0.63	0.85	0.94	0.97	(94)

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

(95)m=	367.47	407.4	441.48	448.54	398.36	289.92	198.45	206.59	296.73	351.67	351.13	351.98	(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=	774.73	754.38	689.78	580.19	449.43	301.82	200.99	210.44	326.04	488.61	640.88	768.94	(97)

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

(98)m=	303	233.17	184.74	94.78	37.99	0	0	0	0	101.88	208.62	310.21

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1474.4 (98)

Space heating requirement in kWh/m²/year 27.3 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community boilers 1 (303a)

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

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

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1474.4

Space heat from Community boilers (98) x (304a) x (305) x (306) = 1548.12 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1748.33

If DHW from community scheme:

Water heat from Community boilers (64) x (303a) x (305) x (306) = 1835.75 (310a)

Electricity used for heat distribution 0.01 × [(307a)...(307e) + (310a)...(310e)] = 33.84 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside 115.64 (330a)

warm air heating system fans 0 (330b)

pump for solar water heating 0 (330g)

Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 115.64 (331)

Energy for lighting (calculated in Appendix L) 256.38 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 3755.88 (338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel 91 (367a)

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CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	803.2	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	17.56	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	820.76	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			820.76	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	60.02	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	133.06	(379)
Total CO2, kg/year	sum of (376)…(382) =			1013.84	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.77	(384)
EI rating (section 14)				86.28	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 21

Address : Flat_21

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	115.23 (1a)	x	2.7 (2a)	=	311.12	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	115.23 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		311.12	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

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

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 2			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 5			5.61	x	1/[1/(1.4)+ 0.04]	=	7.44			(27)
Windows Type 6			5.61	x	1/[1/(1.4)+ 0.04]	=	7.44			(27)
Walls Type1	72.06	18.26	53.8	x	0.18	=	9.68	70	3766	(29)
Walls Type2	5.1	1.89	3.21	x	0.23	=	0.75	70	224.7	(29)
Roof	115.23	0	115.23	x	0.1	=	11.52	9	1037.07	(30)
Total area of elements, m²			192.39							(31)
Party wall			52.11	x	0	=	0	45	2344.95	(32)
Party floor			115					40	4600	(32a)
Internal wall **			100					9	900	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 48.81 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12872.72 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 111.71 (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 — 17.27 (36)

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

Total fabric heat loss (33) + (36) = 66.08 (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=	28.75	28.43	28.1	26.46	26.14	24.5	24.5	24.17	25.15	26.14	26.79	27.44	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	94.83	94.51	94.18	92.54	92.21	90.58	90.58	90.25	91.23	92.21	92.87	93.52	

Average = Sum(39)$_{1...12}$ /12= 92.46 (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.82	0.82	0.8	0.8	0.79	0.79	0.78	0.79	0.8	0.81	0.81	

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.84 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 101.72 (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=	111.89	107.82	103.75	99.68	95.61	91.55	91.55	95.61	99.68	103.75	107.82	111.89	

Total = Sum(44)$_{1...12}$ = 1220.61 (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=	165.93	145.12	149.75	130.56	125.27	108.1	100.17	114.95	116.32	135.56	147.98	160.69	

Total = Sum(45)$_{1...12}$ = 1600.41 (45)

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

(46)m=	24.89	21.77	22.46	19.58	18.79	16.22	15.03	17.24	17.45	20.33	22.2	24.1	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.19 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.71 (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0 (54)
Enter (50) or (54) in (55)		0.71 (55)

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

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	211.32	186.13	195.15	174.49	170.67	152.03	145.57	160.35	160.25	180.96	191.91	206.09	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	211.32	186.13	195.15	174.49	170.67	152.03	145.57	160.35	160.25	180.96	191.91	206.09	

Output from water heater (annual)$_{1...12}$ 2134.92 (64)

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

(65)m=	91.49	81.06	86.11	78.56	77.97	71.09	69.62	74.54	73.82	81.39	84.35	89.75	(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=	142.14	142.14	142.14	142.14	142.14	142.14	142.14	142.14	142.14	142.14	142.14	142.14	(66)

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

(67)m=	25.99	23.08	18.77	14.21	10.62	8.97	9.69	12.6	16.91	21.47	25.05	26.71	(67)

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

(68)m=	278.87	281.76	274.47	258.94	239.35	220.93	208.62	205.73	213.02	228.55	248.14	266.56	(68)

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

(69)m=	37.21	37.21	37.21	37.21	37.21	37.21	37.21	37.21	37.21	37.21	37.21	37.21	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	(71)

Water heating gains (Table 5)

(72)m=	122.97	120.62	115.74	109.11	104.8	98.74	93.58	100.19	102.53	109.4	117.15	120.63	(72)

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

(73)m=	493.46	491.1	474.62	447.9	420.41	394.28	377.54	384.15	398.1	425.05	455.99	479.54	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)

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North	0.9x	0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
South	0.9x	0.77	x	5.61	x	46.75	x	0.63	x	0.7	=	80.16	(78)
South	0.9x	0.77	x	5.61	x	46.75	x	0.63	x	0.7	=	80.16	(78)
South	0.9x	0.77	x	5.61	x	76.57	x	0.63	x	0.7	=	131.27	(78)
South	0.9x	0.77	x	5.61	x	76.57	x	0.63	x	0.7	=	131.27	(78)
South	0.9x	0.77	x	5.61	x	97.53	x	0.63	x	0.7	=	167.22	(78)
South	0.9x	0.77	x	5.61	x	97.53	x	0.63	x	0.7	=	167.22	(78)
South	0.9x	0.77	x	5.61	x	110.23	x	0.63	x	0.7	=	189	(78)
South	0.9x	0.77	x	5.61	x	110.23	x	0.63	x	0.7	=	189	(78)
South	0.9x	0.77	x	5.61	x	114.87	x	0.63	x	0.7	=	196.95	(78)
South	0.9x	0.77	x	5.61	x	114.87	x	0.63	x	0.7	=	196.95	(78)
South	0.9x	0.77	x	5.61	x	110.55	x	0.63	x	0.7	=	189.53	(78)
South	0.9x	0.77	x	5.61	x	110.55	x	0.63	x	0.7	=	189.53	(78)
South	0.9x	0.77	x	5.61	x	108.01	x	0.63	x	0.7	=	185.19	(78)
South	0.9x	0.77	x	5.61	x	108.01	x	0.63	x	0.7	=	185.19	(78)
South	0.9x	0.77	x	5.61	x	104.89	x	0.63	x	0.7	=	179.84	(78)
South	0.9x	0.77	x	5.61	x	104.89	x	0.63	x	0.7	=	179.84	(78)
South	0.9x	0.77	x	5.61	x	101.89	x	0.63	x	0.7	=	174.68	(78)
South	0.9x	0.77	x	5.61	x	101.89	x	0.63	x	0.7	=	174.68	(78)
South	0.9x	0.77	x	5.61	x	82.59	x	0.63	x	0.7	=	141.59	(78)
South	0.9x	0.77	x	5.61	x	82.59	x	0.63	x	0.7	=	141.59	(78)
South	0.9x	0.77	x	5.61	x	55.42	x	0.63	x	0.7	=	95.01	(78)
South	0.9x	0.77	x	5.61	x	55.42	x	0.63	x	0.7	=	95.01	(78)
South	0.9x	0.77	x	5.61	x	40.4	x	0.63	x	0.7	=	69.26	(78)
South	0.9x	0.77	x	5.61	x	40.4	x	0.63	x	0.7	=	69.26	(78)

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

(83)m=	183.19	306.27	408.73	497.32	554.64	551.16	531.04	487.15	438.69	335.23	218.25	157.6	(83)

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

(84)m=	676.65	797.37	883.35	945.23	975.05	945.43	908.58	871.31	836.79	760.28	674.24	637.14	(84)

7. Mean internal temperature (heating season)

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

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

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

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(86)m=	0.97	0.95	0.91	0.84	0.73	0.57	0.43	0.46	0.66	0.86	0.95	0.98	(86)

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

(87)m=	19.5	19.76	20.09	20.47	20.76	20.93	20.98	20.98	20.88	20.5	19.94	19.46	(87)

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

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

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

(89)m=	0.97	0.94	0.9	0.82	0.69	0.51	0.36	0.39	0.61	0.84	0.94	0.97	(89)

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

(90)m=	18.2	18.58	19.05	19.59	19.98	20.2	20.25	20.25	20.14	19.65	18.85	18.14	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

(92)m=	18.65	18.99	19.41	19.9	20.25	20.45	20.51	20.5	20.39	19.95	19.23	18.6	(92)

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

(93)m=	18.65	18.99	19.41	19.9	20.25	20.45	20.51	20.5	20.39	19.95	19.23	18.6	(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=	0.95	0.93	0.88	0.81	0.69	0.53	0.38	0.41	0.62	0.83	0.93	0.96	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	646.15	739.06	781.18	765.1	675.36	499.62	346.62	360.55	518.01	629.57	626.23	612.75	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1360.9	1331.28	1216.09	1017.87	788.64	530.22	353.73	370.16	574.05	861.87	1126.36	1346.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	531.78	397.97	323.57	181.99	84.28	0	0	0	0	172.83	360.09	546.03	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2598.54 (98)

Space heating requirement in kWh/m²/year 22.55 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community boilers 1 (303a)

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

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

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating	**kWh/year**
Annual space heating requirement	2598.54

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Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2728.47	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2134.92	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2241.66	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	49.7	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		246.72	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	246.72	(331)
Energy for lighting (calculated in Appendix L)		458.93	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5675.78	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1179.72	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.79	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1205.52	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1205.52	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	128.05	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	238.19	(379)
Total CO2, kg/year	sum of (376)…(382) =				1571.75	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				13.64	(384)
EI rating (section 14)					86.86	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 22

Address : Flat_22

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.11	(1a) x	2.7	(2a) =	210.9	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.11	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.9	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 2			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 3			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 4			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 5			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Walls Type1	56.62	12.92	43.7	x	0.18	=	7.87	70	3059	(29)
Walls Type2	8.1	0	8.1	x	0.23	=	1.89	70	567	(29)
Walls Type3	22.09	1.89	20.2	x	0.23	=	4.72	70	1414	(29)
Roof	78.11	0	78.11	x	0.1	=	7.81	9	702.99	(30)
Total area of elements, m²			164.92							(31)
Party wall			23.73	x	0	=	0	45	1067.85	(32)
Party floor			78					40	3120	(32a)
Internal wall **			80					9	720	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.07 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10650.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 136.36 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 11.73 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 53.8 (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=	19.49	19.27	19.05	17.94	17.72	16.61	16.61	16.39	17.05	17.72	18.16	18.6	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.29	73.07	72.85	71.74	71.51	70.41	70.41	70.18	70.85	71.51	71.96	72.4	

Average = Sum(39)$_{1...12}$ /12= 71.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.94	0.94	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.93	

Average = Sum(40)$_{1...12}$ /12= 0.92 (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 — 2.43 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 91.82 (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=	101	97.33	93.65	89.98	86.31	82.64	82.64	86.31	89.98	93.65	97.33	101	

Total = Sum(44)$_{1...12}$ = 1101.82 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.78	131	135.18	117.85	113.08	97.58	90.42	103.76	105	122.37	133.57	145.05	

Total = Sum(45)$_{1...12}$ = 1444.65 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.47	19.65	20.28	17.68	16.96	14.64	13.56	15.56	15.75	18.36	20.04	21.76	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.19 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.71 (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.71	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	195.18	172	180.57	161.78	158.48	141.51	135.82	149.16	148.93	167.77	177.51	190.45	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	195.18	172	180.57	161.78	158.48	141.51	135.82	149.16	148.93	167.77	177.51	190.45	

Output from water heater (annual)$_{1...12}$ 1979.16 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.12	76.36	81.26	74.33	73.92	67.59	66.38	70.82	70.06	77	79.56	84.55	(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=	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.91	17.68	14.38	10.89	8.14	6.87	7.42	9.65	12.95	16.45	19.2	20.46	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.45	217.68	212.05	200.05	184.91	170.68	161.18	158.94	164.58	176.57	191.71	205.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	(71)

Water heating gains (Table 5)

(72)m=	115.75	113.63	109.23	103.24	99.35	93.88	89.22	95.19	97.3	103.5	110.5	113.64	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.5	408.39	395.04	373.57	351.79	330.82	317.22	323.17	334.22	355.91	380.79	399.43	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x 0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x 0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x 0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x 0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x 0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x 0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x 0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x 0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x 0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x 0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x 0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x 0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x 0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x 0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x 0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x 0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x 0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x 0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x 0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x 0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x 0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x 0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x 0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x 0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x 0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x 0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x 0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x 0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x 0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x 0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x 0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)
South	0.9x 0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)
South	0.9x 0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)
West	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(80)
West	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(80)
West	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(80)

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West	0.9x	0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(80)
West	0.9x	0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(80)
West	0.9x	0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(80)
West	0.9x	0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(80)
West	0.9x	0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(80)
West	0.9x	0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(80)
West	0.9x	0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(80)
West	0.9x	0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(80)
West	0.9x	0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(80)
West	0.9x	0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(80)
West	0.9x	0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(80)
West	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(80)
West	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(80)
West	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(80)
West	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(80)
West	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(80)
West	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(80)
West	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(80)
West	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(80)
West	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(80)
West	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m ...(82)m

(83)m=	121.3	213.26	305.12	393.34	449.42	448.69	431.64	390.32	336.23	239.71	146.6	102.9	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	531.8	621.65	700.16	766.91	801.21	779.52	748.86	713.49	670.45	595.62	527.4	502.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.95	0.91	0.84	0.71	0.55	0.41	0.44	0.65	0.87	0.95	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.59	19.83	20.17	20.54	20.81	20.95	20.99	20.98	20.9	20.54	20	19.55	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.17	20.17	20.17	20.16	20.15	20.15	20.14	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.95	0.9	0.81	0.67	0.48	0.33	0.37	0.59	0.84	0.95	0.97	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.25	18.6	19.08	19.6	19.95	20.12	20.16	20.16	20.07	19.62	18.86	18.19	(90)

fLA = Living area ÷ (4) = 0.35 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

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(92)m=	18.71	19.03	19.45	19.93	20.25	20.41	20.44	20.44	20.35	19.94	19.25	18.66	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.71	19.03	19.45	19.93	20.25	20.41	20.44	20.44	20.35	19.94	19.25	18.66	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.96	0.93	0.89	0.8	0.67	0.5	0.36	0.39	0.61	0.83	0.93	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	509.95	579.9	620.97	614.7	538.8	391.39	267.06	278.57	406.67	495.8	492.67	484.83	(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=	1056.2	1032.09	943.55	791.1	611.15	408.92	270.7	283.72	443	667.71	874.44	1046.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	406.41	303.88	240	127	53.83	0	0	0	0	127.9	274.87	418.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1952.13	(98)
Space heating requirement in kWh/m²/year	24.99	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers	1	(303a)
Fraction of total space heat from Community boilers (302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1952.13	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2049.74	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		1979.16	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2078.12	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.28	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

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Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		167.24	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	167.24	(331)
Energy for lighting (calculated in Appendix L)		351.62	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4646.72	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	979.8	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.42	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	1001.22	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1001.22	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	86.8	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	182.49	(379)
Total CO2, kg/year	sum of (376)...(382) =				1270.51	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.27	(384)
EI rating (section 14)					86.17	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 23

Address : Flat_23

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	88.4	(1a) x	2.7	(2a) =	238.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	88.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		238.68	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 2			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 5			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Walls Type1	56.65	12.92	43.73	x	0.18	=	7.87	70	3061.1	(29)
Walls Type2	13.69	0	13.69	x	0.23	=	3.2	70	958.3	(29)
Walls Type3	21.98	1.89	20.09	x	0.23	=	4.7	70	1406.3	(29)
Roof	88.4	0	88.4	x	0.1	=	8.84	9	795.6	(30)
Total area of elements, m²			180.72							(31)
Party wall			28.38	x	0	=	0	45	1277.1	(32)
Party floor			88					40	3520	(32a)
Internal wall **			80					9	720	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 44.39 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11738.4 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 132.79 (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 — 12.41 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 56.79 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	22.06	21.81	21.56	20.3	20.05	18.8	18.8	18.54	19.3	20.05	20.55	21.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.85	78.6	78.35	77.09	76.84	75.59	75.59	75.34	76.09	76.84	77.34	77.85	

Average = Sum(39)$_{1...12}$ /12= 77.03 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.89	0.89	0.89	0.87	0.87	0.86	0.86	0.85	0.86	0.87	0.87	0.88	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.6 (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 — 96.03 (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=	105.63	101.79	97.95	94.11	90.26	86.42	86.42	90.26	94.11	97.95	101.79	105.63	

Total = Sum(44)$_{1...12}$ = 1152.31 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	156.64	137	141.37	123.25	118.26	102.05	94.57	108.52	109.81	127.98	139.7	151.7	

Total = Sum(45)$_{1...12}$ = 1510.86 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.5	20.55	21.21	18.49	17.74	15.31	14.19	16.28	16.47	19.2	20.95	22.76	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.19 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.71 (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.71	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.04	178	186.77	167.18	163.66	145.98	139.96	153.91	153.74	173.37	183.63	197.1	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.04	178	186.77	167.18	163.66	145.98	139.96	153.91	153.74	173.37	183.63	197.1	

Output from water heater (annual)$_{1...12}$ 2045.36 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.4	78.36	83.32	76.13	75.64	69.08	67.76	72.4	71.66	78.87	81.59	86.76	(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=	130.16	130.16	130.16	130.16	130.16	130.16	130.16	130.16	130.16	130.16	130.16	130.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.37	19.87	16.16	12.23	9.15	7.72	8.34	10.84	14.56	18.48	21.57	22.99	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	236.1	238.55	232.38	219.24	202.64	187.05	176.63	174.18	180.36	193.5	210.09	225.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.02	36.02	36.02	36.02	36.02	36.02	36.02	36.02	36.02	36.02	36.02	36.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	-104.13	(71)

Water heating gains (Table 5)

(72)m=	118.82	116.6	111.99	105.73	101.67	95.94	91.08	97.31	99.53	106.01	113.33	116.61	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	439.34	437.07	422.58	399.25	375.5	352.76	338.1	344.39	356.49	380.04	407.04	427.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x 0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x 0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x 0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x 0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x 0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x 0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
West	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(80)
West	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(80)
West	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(80)

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DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(80)
West	0.9x	0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(80)
West	0.9x	0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(80)
West	0.9x	0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(80)
West	0.9x	0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(80)
West	0.9x	0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(80)
West	0.9x	0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(80)
West	0.9x	0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(80)
West	0.9x	0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(80)
West	0.9x	0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(80)
West	0.9x	0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(80)
West	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(80)
West	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(80)
West	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(80)
West	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(80)
West	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(80)
West	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(80)
West	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(80)
West	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(80)
West	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(80)
West	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m ...(82)m

(83)m=	63.02	122.5	203.45	304.96	384.62	399.38	377.85	316.66	238.82	145.48	78.35	52.02	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	502.36	559.57	626.04	704.21	760.13	752.14	715.95	661.04	595.3	525.51	485.38	479.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.97	0.95	0.89	0.77	0.6	0.45	0.5	0.74	0.92	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.5	19.68	20.01	20.43	20.76	20.93	20.98	20.97	20.85	20.42	19.89	19.47	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.18	20.18	20.19	20.19	20.21	20.21	20.21	20.2	20.19	20.19	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.97	0.94	0.87	0.73	0.54	0.38	0.42	0.69	0.9	0.97	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.15	18.42	18.89	19.49	19.93	20.15	20.19	20.19	20.05	19.49	18.73	18.11	(90)

fLA = Living area ÷ (4) = 0.31 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

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(92)m=	18.56	18.8	19.23	19.78	20.18	20.39	20.44	20.43	20.29	19.77	19.09	18.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.56	18.8	19.23	19.78	20.18	20.39	20.44	20.43	20.29	19.77	19.09	18.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.96	0.93	0.86	0.73	0.55	0.4	0.45	0.69	0.89	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	488.59	536.67	580.97	602.5	553.39	413.4	284.67	295.44	412.48	468.16	464.82	468.04	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1124.34	1092.78	997.38	838.81	651.76	437.54	289.92	303.61	471.24	704.76	927.07	1115.28	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	473	373.71	309.81	170.14	73.18	0	0	0	0	176.03	332.81	481.54	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2390.23	(98)
Space heating requirement in kWh/m²/year	27.04	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers	1	(303a)
Fraction of total space heat from Community boilers (302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2390.23	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2509.74	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2045.36	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2147.63	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	46.57	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

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Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		189.27	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	189.27	(331)
Energy for lighting (calculated in Appendix L)		395.12	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5241.76	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1105.49	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	24.17	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	1129.66	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1129.66	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	98.23	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	205.07	(379)
Total CO2, kg/year	sum of (376)...(382) =				1432.95	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.21	(384)
EI rating (section 14)					85.61	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 24

Address : Flat_24

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	115.23 (1a)	x	2.7 (2a)	=	311.12	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	115.23 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		311.12	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 2			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 5			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 6			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 7			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Walls Type1	72.06	16.44	55.62	x	0.18	=	10.01	70	3893.4	(29)
Walls Type2	5.1	1.89	3.21	x	0.23	=	0.75	70	224.7	(29)
Roof	115.23	0	115.23	x	0.1	=	11.52	9	1037.07	(30)
Total area of elements, m²			192.39							(31)
Party wall			52.11	x	0	=	0	45	2344.95	(32)
Party floor			115					40	4600	(32a)
Internal wall **			100					9	900	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.73 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13000.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 112.82 (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 — 15.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 62.68 (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=	28.75	28.43	28.1	26.46	26.14	24.5	24.5	24.17	25.15	26.14	26.79	27.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	91.43	91.1	90.78	89.14	88.81	87.18	87.18	86.85	87.83	88.81	89.47	90.12	

Average = Sum(39)$_{1...12}$ /12= 89.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.79	0.79	0.79	0.77	0.77	0.76	0.76	0.75	0.76	0.77	0.78	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.77 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.84 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 101.72 (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=	111.89	107.82	103.75	99.68	95.61	91.55	91.55	95.61	99.68	103.75	107.82	111.89	

Total = Sum(44)$_{1...12}$ = 1220.61 (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=	165.93	145.12	149.75	130.56	125.27	108.1	100.17	114.95	116.32	135.56	147.98	160.69	

Total = Sum(45)$_{1...12}$ = 1600.41 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.89	21.77	22.46	19.58	18.79	16.22	15.03	17.24	17.45	20.33	22.2	24.1	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.19 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.71 (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0 (54)
Enter (50) or (54) in (55)		0.71 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.32	186.13	195.15	174.49	170.67	152.03	145.57	160.35	160.25	180.96	191.91	206.09	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.32	186.13	195.15	174.49	170.67	152.03	145.57	160.35	160.25	180.96	191.91	206.09	

Output from water heater (annual)$_{1...12}$: 2134.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.49	81.06	86.11	78.56	77.97	71.09	69.62	74.54	73.82	81.39	84.35	89.75	(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=	142.14	142.14	142.14	142.14	142.14	142.14	142.14	142.14	142.14	142.14	142.14	142.14	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.56	23.59	19.19	14.53	10.86	9.17	9.91	12.87	17.28	21.94	25.61	27.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	278.87	281.76	274.47	258.94	239.35	220.93	208.62	205.73	213.02	228.55	248.14	266.56	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.21	37.21	37.21	37.21	37.21	37.21	37.21	37.21	37.21	37.21	37.21	37.21	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	-113.71	(71)

Water heating gains (Table 5)

(72)m=	122.97	120.62	115.74	109.11	104.8	98.74	93.58	100.19	102.53	109.4	117.15	120.63	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	494.04	491.61	475.04	448.22	420.65	394.47	377.75	384.43	398.48	425.53	456.55	480.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	3.82	x	10.63	x	0.63	x	0.7	=	12.41	(74)
North	0.9x 0.77	x	3.82	x	10.63	x	0.63	x	0.7	=	12.41	(74)
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	3.82	x	20.32	x	0.63	x	0.7	=	23.72	(74)
North	0.9x 0.77	x	3.82	x	20.32	x	0.63	x	0.7	=	23.72	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	3.82	x	34.53	x	0.63	x	0.7	=	40.31	(74)
North	0.9x 0.77	x	3.82	x	34.53	x	0.63	x	0.7	=	40.31	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	3.82	x	55.46	x	0.63	x	0.7	=	64.75	(74)
North	0.9x 0.77	x	3.82	x	55.46	x	0.63	x	0.7	=	64.75	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	3.82	x	74.72	x	0.63	x	0.7	=	87.23	(74)
North	0.9x 0.77	x	3.82	x	74.72	x	0.63	x	0.7	=	87.23	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	3.82	x	79.99	x	0.63	x	0.7	=	93.38	(74)
North	0.9x 0.77	x	3.82	x	79.99	x	0.63	x	0.7	=	93.38	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	3.82	x	74.68	x	0.63	x	0.7	=	87.18	(74)
North	0.9x 0.77	x	3.82	x	74.68	x	0.63	x	0.7	=	87.18	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	3.82	x	59.25	x	0.63	x	0.7	=	69.17	(74)
North	0.9x 0.77	x	3.82	x	59.25	x	0.63	x	0.7	=	69.17	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	3.82	x	41.52	x	0.63	x	0.7	=	48.47	(74)
North	0.9x 0.77	x	3.82	x	41.52	x	0.63	x	0.7	=	48.47	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	3.82	x	24.19	x	0.63	x	0.7	=	28.24	(74)
North	0.9x 0.77	x	3.82	x	24.19	x	0.63	x	0.7	=	28.24	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x 0.77	x	3.82	x	13.12	x	0.63	x	0.7	=	15.31	(74)
North	0.9x 0.77	x	3.82	x	13.12	x	0.63	x	0.7	=	15.31	(74)
North	0.9x 0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x 0.77	x	3.82	x	8.86	x	0.63	x	0.7	=	10.35	(74)
North	0.9x 0.77	x	3.82	x	8.86	x	0.63	x	0.7	=	10.35	(74)
North	0.9x 0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)

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South	0.9x	0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x	0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x	0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x	0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x	0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x	0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x	0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x	0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x	0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x	0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x	0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x	0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x	0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x	0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x	0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x	0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x	0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)

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South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)
South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)
South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)
South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	131.14	223.11	309.04	396.51	461.79	467.62	446.92	395.88	338.48	247.17	156.91	112.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	625.17	714.73	784.08	844.72	882.43	862.1	824.67	780.32	736.95	672.7	613.46	592.52	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.93	0.87	0.76	0.6	0.45	0.49	0.71	0.89	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.51	19.73	20.05	20.44	20.75	20.93	20.98	20.97	20.86	20.47	19.93	19.48	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.26	20.26	20.26	20.28	20.28	20.29	20.29	20.29	20.29	20.28	20.27	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.97	0.96	0.92	0.85	0.73	0.54	0.38	0.42	0.66	0.87	0.95	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.23	18.55	19.01	19.57	19.99	20.22	20.28	20.27	20.14	19.62	18.85	18.19	(90)

fLA = Living area ÷ (4) = 0.35 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.68	18.96	19.37	19.87	20.25	20.47	20.52	20.52	20.39	19.92	19.23	18.64	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.68	18.96	19.37	19.87	20.25	20.47	20.52	20.52	20.39	19.92	19.23	18.64	(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:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.96	0.94	0.91	0.84	0.73	0.56	0.41	0.44	0.66	0.86	0.94	0.97	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	602.41	674.33	712.83	710.27	639.84	479.65	334.45	347.05	489.33	579.04	578.55	574.08	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1314.43	1281.12	1168.29	978.1	759.5	511.49	341.85	357.5	552.55	827.48	1084.96	1301.09	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	529.74	407.76	338.86	192.84	89.03	0	0	0	0	184.84	364.62	540.9	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2648.58 (98)

Space heating requirement in kWh/m²/year 22.99 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2648.58	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2781.01	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2134.92	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2241.66	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	50.23	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		246.72	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	246.72	(331)
Energy for lighting (calculated in Appendix L)		469.1	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5738.49	(338)

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12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1192.2	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.07	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1218.26	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)

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Total CO2 associated with space and water heating	(373) + (374) + (375) =			1218.26	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	128.05	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	243.46	(379)
Total CO2, kg/year	sum of (376)…(382) =			1589.77	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.8	(384)
EI rating (section 14)				86.7	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 25

Address : Flat_25

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.98	(1a) x	2.7	(2a) =	145.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =			0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 2			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Walls Type1	35.45	9.1	26.35	x	0.18	=	4.74	70	1844.5	(29)
Walls Type2	19.79	0	19.79	x	0.23	=	4.63	70	1385.3	(29)
Walls Type3	6.94	1.89	5.05	x	0.23	=	1.18	70	353.5	(29)
Roof	53.98	0	53.98	x	0.1	=	5.4	9	485.82	(30)
Total area of elements, m²			116.16							(31)
Party wall			23.14	x	0	=	0	45	1041.3	(32)
Party floor			54					40	2160	(32a)
Internal wall **			60					9	540	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.66 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7810.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 144.69 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.09 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 39.75 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	13.47	13.32	13.16	12.4	12.24	11.48	11.48	11.32	11.78	12.24	12.55	12.86	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	53.22	53.06	52.91	52.14	51.99	51.22	51.22	51.07	51.53	51.99	52.3	52.6	

Average = Sum(39)$_{1...12}$ /12= 52.1 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.99	0.98	0.98	0.97	0.96	0.95	0.95	0.95	0.95	0.96	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.81 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.84	81.75	78.67	75.58	72.5	69.41	69.41	72.5	75.58	78.67	81.75	84.84	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 925.51 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	125.81	110.04	113.55	98.99	94.99	81.97	75.95	87.16	88.2	102.79	112.2	121.84	

Total = Sum(45)$_{1...12}$ = 1213.49 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.87	16.51	17.03	14.85	14.25	12.3	11.39	13.07	13.23	15.42	16.83	18.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 120 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.19 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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) 0.71 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	171.21	151.04	158.94	142.93	140.38	125.9	121.35	132.56	132.13	148.18	156.13	167.24	(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=	171.21	151.04	158.94	142.93	140.38	125.9	121.35	132.56	132.13	148.18	156.13	167.24	

Output from water heater (annual)$_{1,12}$ | 1748 | (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=	78.15	69.39	74.07	68.06	67.9	62.4	61.57	65.3	64.47	70.49	72.45	76.83	(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=	90.37	90.37	90.37	90.37	90.37	90.37	90.37	90.37	90.37	90.37	90.37	90.37	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.51	12.89	10.48	7.93	5.93	5.01	5.41	7.03	9.44	11.98	13.99	14.91	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.55	159.19	155.07	146.3	135.23	124.82	117.87	116.23	120.35	129.12	140.2	150.6	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	(71)

Water heating gains (Table 5)

(72)m=	105.04	103.26	99.56	94.53	91.26	86.67	82.76	87.77	89.54	94.75	100.63	103.27	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	327.21	325.44	315.22	298.87	282.53	266.6	256.15	261.14	269.45	285.97	304.92	318.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(76)
East	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(76)
East	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(76)
East	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(76)
East	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(76)
East	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(76)
East	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(76)
East	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(76)
East	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(76)
East	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(76)
East	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(76)
East	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(76)
East	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(76)
East	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(76)
East	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(76)
East	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(76)
East	0.9x 0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(76)
East	0.9x 0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(76)
East	0.9x 0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(76)
East	0.9x 0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(76)
East	0.9x 0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(76)
East	0.9x 0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(76)
East	0.9x 0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(76)
East	0.9x 0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(76)
West	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(80)
West	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(80)
West	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(80)
West	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(80)
West	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(80)
West	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(80)
West	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(80)
West	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(80)

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West	0.9x	0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92		(80)
West	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91		(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58		(80)
West	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22		(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52		(80)
West	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59		(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17		(80)
West	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86		(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	54.62	106.85	175.97	256.64	314.52	321.97	306.53	263.3	204.66	126.79	68.11	44.92	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	381.83	432.3	491.19	555.51	597.05	588.57	562.67	524.44	474.11	412.76	373.03	363.81	(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=	0.97	0.96	0.92	0.84	0.7	0.53	0.39	0.44	0.67	0.88	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.59	19.8	20.14	20.55	20.82	20.95	20.99	20.98	20.89	20.51	19.99	19.55	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.11	20.11	20.13	20.13	20.13	20.12	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.95	0.91	0.81	0.65	0.47	0.32	0.36	0.6	0.86	0.95	0.97	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.21	18.52	19.01	19.57	19.93	20.09	20.12	20.12	20.02	19.54	18.8	18.17	(90)

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.85	19.11	19.53	20.02	20.34	20.49	20.52	20.52	20.42	19.99	19.35	18.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.85	19.11	19.53	20.02	20.34	20.49	20.52	20.52	20.42	19.99	19.35	18.81	(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=	0.96	0.94	0.9	0.81	0.67	0.49	0.35	0.39	0.63	0.85	0.94	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	367.35	407.28	441.35	448.4	398.21	289.8	198.37	206.5	296.61	351.56	351.02	351.87	(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=	774.38	754.05	689.48	579.93	449.23	301.69	200.9	210.35	325.9	488.4	640.59	768.59	(97)

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	302.83	233.03	184.61	94.7	37.96	0	0	0	0	101.81	208.49	310.04

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1473.46 (98)

Space heating requirement in kWh/m²/year 27.3 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1473.46

Space heat from Community boilers (98) x (304a) x (305) x (306) = 1547.13 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1748

If DHW from community scheme:

Water heat from Community boilers (64) x (303a) x (305) x (306) = 1835.4 (310a)

Electricity used for heat distribution 0.01 × [(307a)...(307e) + (310a)...(310e)] = 33.83 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside 115.58 (330a)

warm air heating system fans 0 (330b)

pump for solar water heating 0 (330g)

Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 115.58 (331)

Energy for lighting (calculated in Appendix L) 256.23 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 3754.34 (338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel 91 (367a)

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CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	802.89	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	17.56	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	820.44	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			820.44	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	59.98	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	132.98	(379)
Total CO2, kg/year	sum of (376)…(382) =			1013.41	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.77	(384)
EI rating (section 14)				86.28	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 26

Address : Flat_26

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54.01	(1a) x	2.7	(2a) =	145.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145.83	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =		0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 2			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Walls Type1	35.48	9.1	26.38	x	0.18	=	4.75	70	1846.6	(29)
Walls Type2	19.82	0	19.82	x	0.23	=	4.64	70	1387.4	(29)
Walls Type3	6.94	1.89	5.05	x	0.23	=	1.18	70	353.5	(29)
Roof	54.01	0	54.01	x	0.1	=	5.4	9	486.09	(30)
Total area of elements, m²			116.25							(31)
Party wall			23.14	x	0	=	0	45	1041.3	(32)
Party floor			54					40	2160	(32a)
Internal wall **			60					9	540	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.68 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7814.89 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 144.69 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.09 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 39.76 (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=	13.48	13.32	13.17	12.4	12.25	11.48	11.48	11.33	11.79	12.25	12.56	12.86	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	53.24	53.09	52.93	52.17	52.01	51.25	51.25	51.09	51.55	52.01	52.32	52.63	

Average = Sum(39)$_{1...12}$ /12= 52.13 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.99	0.98	0.98	0.97	0.96	0.95	0.95	0.95	0.95	0.96	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.81 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.86	81.78	78.69	75.6	72.52	69.43	69.43	72.52	75.6	78.69	81.78	84.86	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 925.76 (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=	125.85	110.07	113.58	99.02	95.01	81.99	75.98	87.18	88.22	102.82	112.23	121.88	

Total = Sum(45)$_{1...12}$ = 1213.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.88	16.51	17.04	14.85	14.25	12.3	11.4	13.08	13.23	15.42	16.83	18.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 120 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.19 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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) 0.71 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	171.24	151.07	158.98	142.95	140.41	125.92	121.37	132.58	132.16	148.21	156.16	167.27	(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=	171.24	151.07	158.98	142.95	140.41	125.92	121.37	132.58	132.16	148.21	156.16	167.27	

Output from water heater (annual)$_{1,12}$ | 1748.33 | (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=	78.16	69.4	74.08	68.07	67.91	62.41	61.58	65.31	64.48	70.5	72.46	76.84	(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=	90.41	90.41	90.41	90.41	90.41	90.41	90.41	90.41	90.41	90.41	90.41	90.41	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.52	12.89	10.49	7.94	5.93	5.01	5.41	7.04	9.44	11.99	14	14.92	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.63	159.27	155.14	146.37	135.29	124.88	117.93	116.29	120.41	129.19	140.26	150.68	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	-72.33	(71)

Water heating gains (Table 5)

(72)m=	105.06	103.27	99.57	94.54	91.28	86.68	82.77	87.78	89.56	94.76	100.64	103.28	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	327.33	325.56	315.33	298.97	282.63	266.69	256.23	261.23	269.54	286.07	305.03	319	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(76)
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(76)
East	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x 0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(76)
East	0.9x 0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x 0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(76)
East	0.9x 0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x 0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(76)
East	0.9x 0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x 0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(76)
East	0.9x 0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
West	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)

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West	0.9x	0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	54.62	106.85	175.97	256.64	314.52	321.97	306.53	263.3	204.66	126.79	68.11	44.92	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	381.95	432.41	491.3	555.61	597.15	588.66	562.76	524.53	474.19	412.85	373.13	363.92	(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=	0.97	0.96	0.92	0.84	0.7	0.53	0.39	0.44	0.67	0.88	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.59	19.8	20.14	20.55	20.82	20.95	20.99	20.98	20.89	20.51	19.99	19.55	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.11	20.11	20.13	20.13	20.13	20.12	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.95	0.91	0.81	0.65	0.47	0.32	0.36	0.6	0.86	0.95	0.97	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.21	18.52	19.01	19.57	19.93	20.09	20.12	20.12	20.02	19.54	18.8	18.17	(90)

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.85	19.11	19.53	20.02	20.34	20.49	20.52	20.52	20.42	19.99	19.35	18.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.85	19.11	19.53	20.02	20.34	20.49	20.52	20.52	20.42	19.99	19.35	18.81	(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=	0.96	0.94	0.9	0.81	0.67	0.49	0.35	0.39	0.63	0.85	0.94	0.97	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	367.47	407.4	441.48	448.54	398.36	289.92	198.45	206.59	296.73	351.67	351.13	351.98	(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=	774.73	754.38	689.78	580.19	449.43	301.82	200.99	210.44	326.04	488.61	640.88	768.94	(97)

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	303	233.17	184.74	94.78	37.99	0	0	0	0	101.88	208.62	310.21

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1474.4 (98)

Space heating requirement in kWh/m²/year 27.3 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1474.4

Space heat from Community boilers (98) x (304a) x (305) x (306) = 1548.12 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1748.33

If DHW from community scheme:

Water heat from Community boilers (64) x (303a) x (305) x (306) = 1835.75 (310a)

Electricity used for heat distribution 0.01 × [(307a)...(307e) + (310a)...(310e)] = 33.84 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside 115.64 (330a)

warm air heating system fans 0 (330b)

pump for solar water heating 0 (330g)

Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 115.64 (331)

Energy for lighting (calculated in Appendix L) 256.38 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 3755.88 (338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel 91 (367a)

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CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	803.2	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	17.56	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	820.76	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			820.76	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	60.02	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	133.06	(379)
Total CO2, kg/year	sum of (376)…(382) =			1013.84	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.77	(384)
EI rating (section 14)				86.28	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 27

Address : Flat_27

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.11	(1a) x	2.7	(2a) =	210.9	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.11	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.9	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				3 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15 (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) =			0.13 (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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 2			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 5			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Walls Type1	56.62	12.92	43.7	x	0.18	=	7.87	70	3059	(29)
Walls Type2	8.1	0	8.1	x	0.23	=	1.89	70	567	(29)
Walls Type3	22.09	1.89	20.2	x	0.23	=	4.72	70	1414	(29)
Roof	78.11	0	78.11	x	0.1	=	7.81	9	702.99	(30)
Total area of elements, m²			164.92							(31)
Party wall			23.73	x	0	=	0	45	1067.85	(32)
Party floor			78					40	3120	(32a)
Internal wall **			80					9	720	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.07 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10650.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 136.36 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 11.73 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 53.8 (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=	19.49	19.27	19.05	17.94	17.72	16.61	16.61	16.39	17.05	17.72	18.16	18.6	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.29	73.07	72.85	71.74	71.51	70.41	70.41	70.18	70.85	71.51	71.96	72.4	

Average = Sum(39)$_{1...12}$ /12= 71.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.94	0.94	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.93	

Average = Sum(40)$_{1...12}$ /12= 0.92 (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 — 2.43 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 91.82 (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=	101	97.33	93.65	89.98	86.31	82.64	82.64	86.31	89.98	93.65	97.33	101	

Total = Sum(44)$_{1...12}$ = 1101.82 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.78	131	135.18	117.85	113.08	97.58	90.42	103.76	105	122.37	133.57	145.05	

Total = Sum(45)$_{1...12}$ = 1444.65 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.47	19.65	20.28	17.68	16.96	14.64	13.56	15.56	15.75	18.36	20.04	21.76	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.19 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.71 (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.71	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	195.18	172	180.57	161.78	158.48	141.51	135.82	149.16	148.93	167.77	177.51	190.45	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	195.18	172	180.57	161.78	158.48	141.51	135.82	149.16	148.93	167.77	177.51	190.45	

Output from water heater (annual)$_{1...12}$ 1979.16 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.12	76.36	81.26	74.33	73.92	67.59	66.38	70.82	70.06	77	79.56	84.55	(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=	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.91	17.68	14.38	10.89	8.14	6.87	7.42	9.65	12.95	16.45	19.2	20.46	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.45	217.68	212.05	200.05	184.91	170.68	161.18	158.94	164.58	176.57	191.71	205.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	35.13	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	-97.04	(71)

Water heating gains (Table 5)

(72)m=	115.75	113.63	109.23	103.24	99.35	93.88	89.22	95.19	97.3	103.5	110.5	113.64	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.5	408.39	395.04	373.57	351.79	330.82	317.22	323.17	334.22	355.91	380.79	399.43	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x 0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x 0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x 0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x 0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x 0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x 0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x 0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)

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East	0.9x	0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x	0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x	0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x	0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x	0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x	0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x	0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x	0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x	0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x	0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x	0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x	0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x	0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x	0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x	0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
East	0.9x	0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m ...(82)m

(83)m=	63.02	122.5	203.45	304.96	384.62	399.38	377.85	316.66	238.82	145.48	78.35	52.02	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	473.51	530.88	598.5	678.53	736.42	730.2	695.06	639.83	573.04	501.39	459.14	451.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.97	0.94	0.87	0.75	0.58	0.43	0.49	0.72	0.91	0.97	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.48	19.68	20.02	20.45	20.77	20.94	20.98	20.98	20.85	20.42	19.89	19.45	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.17	20.17	20.17	20.16	20.15	20.15	20.14	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.97	0.93	0.85	0.71	0.51	0.36	0.4	0.67	0.89	0.96	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.1	18.38	18.87	19.48	19.9	20.11	20.16	20.15	20.02	19.46	18.69	18.06	(90)

fLA = Living area ÷ (4) = 0.35 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

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(92)m=	18.58	18.83	19.26	19.81	20.2	20.4	20.44	20.44	20.31	19.79	19.1	18.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.58	18.83	19.26	19.81	20.2	20.4	20.44	20.44	20.31	19.79	19.1	18.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.95	0.92	0.84	0.71	0.53	0.38	0.43	0.68	0.88	0.95	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	459.27	506.89	550.86	571.25	521.82	387.21	265.9	276.1	387.44	442.05	437.85	439.74	(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=	1046.22	1017.65	929.73	782.87	608.15	408.24	270.52	283.33	439.73	657.43	863.72	1038.19	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	436.68	343.24	281.88	152.36	64.23	0	0	0	0	160.24	306.63	445.25	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2190.51	(98)
Space heating requirement in kWh/m²/year	28.04	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers	1	(303a)
Fraction of total space heat from Community boilers (302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2190.51	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2300.03	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		1979.16	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2078.12	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.78	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

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Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		167.24	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	167.24	(331)
Energy for lighting (calculated in Appendix L)		351.62	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4897.01	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1039.21	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.72	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	1061.93	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1061.93	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	86.8	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	182.49	(379)
Total CO2, kg/year	sum of (376)...(382) =				1331.22	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.04	(384)
EI rating (section 14)					85.51	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 28

Address : Flat_28

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.4	(1a) x	2.7	(2a) =	211.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		211.68	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				3 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15 (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) =			0.13 (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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 2			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 5			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Walls Type1	56.65	12.92	43.73	x	0.18	=	7.87	70	3061.1	(29)
Walls Type2	13.69	0	13.69	x	0.23	=	3.2	70	958.3	(29)
Walls Type3	21.98	1.89	20.09	x	0.23	=	4.7	70	1406.3	(29)
Roof	88.4	0	88.4	x	0.1	=	8.84	9	795.6	(30)
Total area of elements, m²			180.72							(31)
Party wall			28.38	x	0	=	0	45	1277.1	(32)
Party floor			78					40	3120	(32a)
Internal wall **			80					9	720	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 44.39 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11338.4 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 144.62 (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 — 12.41 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 56.79 (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=	19.56	19.34	19.12	18	17.78	16.67	16.67	16.45	17.11	17.78	18.23	18.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.36	76.13	75.91	74.8	74.57	73.46	73.46	73.24	73.91	74.57	75.02	75.46	

Average = Sum(39)$_{1...12}$ /12= 74.74 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.97	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.96	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.43 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 91.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	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=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15	

Total = Sum(44)$_{1...12}$ = 1103.46 (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=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27	

Total = Sum(45)$_{1...12}$ = 1446.81 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.19 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.71	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	195.4	172.2	180.78	161.96	158.65	141.66	135.95	149.31	149.09	167.95	177.71	190.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	195.4	172.2	180.78	161.96	158.65	141.66	135.95	149.31	149.09	167.95	177.71	190.67	

Output from water heater (annual)$_{1...12}$ 1981.32 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.19	76.42	81.33	74.39	73.97	67.64	66.43	70.87	70.11	77.07	79.63	84.62	(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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.98	17.75	14.43	10.93	8.17	6.9	7.45	9.69	13	16.51	19.26	20.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	115.85	113.73	109.32	103.32	99.43	93.94	89.28	95.25	97.38	103.58	110.59	113.74	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.37	409.26	395.88	374.35	352.52	331.49	317.85	323.82	334.9	356.64	381.59	400.28	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x 0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x 0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x 0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x 0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x 0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x 0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x 0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
East	0.9x 0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x 0.77	x	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x 0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x 0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x 0.77	x	1.76	x	76.57	x	0.63	x	0.7	=	41.18	(78)
South	0.9x 0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x 0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x 0.77	x	1.76	x	97.53	x	0.63	x	0.7	=	52.46	(78)
South	0.9x 0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x 0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x 0.77	x	1.76	x	110.23	x	0.63	x	0.7	=	59.29	(78)
South	0.9x 0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x 0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)
South	0.9x 0.77	x	1.76	x	114.87	x	0.63	x	0.7	=	61.79	(78)

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South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	110.55	x	0.63	x	0.7	=	59.46	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	108.01	x	0.63	x	0.7	=	58.1	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	104.89	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	101.89	x	0.63	x	0.7	=	54.8	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	82.59	x	0.63	x	0.7	=	44.42	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.76	x	55.42	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)
South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)
South	0.9x	0.77	x	1.76	x	40.4	x	0.63	x	0.7	=	21.73	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m ...(82)m

(83)m=	121.3	213.26	305.12	393.34	449.42	448.69	431.64	390.32	336.23	239.71	146.6	102.9	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	532.67	622.52	701	767.69	801.93	780.19	749.49	714.13	671.13	596.35	528.2	503.18	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.92	0.85	0.73	0.57	0.42	0.46	0.67	0.88	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.58	19.81	20.14	20.52	20.8	20.94	20.99	20.98	20.89	20.53	19.99	19.53	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.12	20.14	20.14	20.14	20.13	20.12	20.12	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.95	0.91	0.83	0.69	0.5	0.34	0.38	0.61	0.86	0.95	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.2	18.55	19.02	19.55	19.91	20.09	20.13	20.13	20.03	19.57	18.8	18.15	(90)

fLA = Living area ÷ (4) = 0.34 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

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(92)m=	18.68	18.98	19.41	19.89	20.21	20.38	20.42	20.42	20.33	19.9	19.21	18.63	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.68	18.98	19.41	19.89	20.21	20.38	20.42	20.42	20.33	19.9	19.21	18.63	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.96	0.94	0.9	0.82	0.69	0.52	0.37	0.4	0.63	0.85	0.94	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	513.85	585.91	630.09	627.97	554.6	405.35	276.87	288.78	419.72	505.38	497.77	488.2	(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=	1097.66	1072.09	979.72	821.69	634.95	424.93	280.89	294.49	460.18	693.34	908.58	1088.65	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	434.35	326.71	260.12	139.47	59.78	0	0	0	0	139.85	295.78	446.74	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2102.81	(98)
Space heating requirement in kWh/m²/year	26.82	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers	1	(303a)
Fraction of total space heat from Community boilers (302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2102.81	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2207.95	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		1981.32	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2080.39	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.88	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

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Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		167.86	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	167.86	(331)
Energy for lighting (calculated in Appendix L)		352.88	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4809.08	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1017.89	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.26	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	1040.15	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1040.15	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	87.12	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	183.14	(379)
Total CO2, kg/year	sum of (376)...(382) =				1310.41	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.71	(384)
EI rating (section 14)					85.77	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Stable Block - Flat 29

Address : Flat_29

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.98	(1a) x	2.7	(2a) =	145.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				3 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15 (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) =			0.13 (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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

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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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 2			3.82	x	1/[1/(1.4)+ 0.04]	=	5.06			(27)
Windows Type 3			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Windows Type 4			1.76	x	1/[1/(1.4)+ 0.04]	=	2.33			(27)
Walls Type1	35.45	9.1	26.35	x	0.18	=	4.74	70	1844.5	(29)
Walls Type2	19.79	0	19.79	x	0.23	=	4.63	70	1385.3	(29)
Walls Type3	6.94	1.89	5.05	x	0.23	=	1.18	70	353.5	(29)
Roof	53.98	0	53.98	x	0.1	=	5.4	9	485.82	(30)
Total area of elements, m²			116.16							(31)
Party wall			23.14	x	0	=	0	45	1041.3	(32)
Party floor			54					40	2160	(32a)
Internal wall **			60					9	540	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.66 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7810.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 144.69 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.09 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 39.75 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	13.47	13.32	13.16	12.4	12.24	11.48	11.48	11.32	11.78	12.24	12.55	12.86	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	53.22	53.06	52.91	52.14	51.99	51.22	51.22	51.07	51.53	51.99	52.3	52.6	

Average = Sum(39)$_{1...12}$ /12= 52.1 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.99	0.98	0.98	0.97	0.96	0.95	0.95	0.95	0.95	0.96	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.81 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.84	81.75	78.67	75.58	72.5	69.41	69.41	72.5	75.58	78.67	81.75	84.84	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 925.51 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	125.81	110.04	113.55	98.99	94.99	81.97	75.95	87.16	88.2	102.79	112.2	121.84	

Total = Sum(45)$_{1...12}$ = 1213.49 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.87	16.51	17.03	14.85	14.25	12.3	11.39	13.07	13.23	15.42	16.83	18.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 120 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.19 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.71 (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) 0.71 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(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=	22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	171.21	151.04	158.94	142.93	140.38	125.9	121.35	132.56	132.13	148.18	156.13	167.24	(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=	171.21	151.04	158.94	142.93	140.38	125.9	121.35	132.56	132.13	148.18	156.13	167.24	

Output from water heater (annual)$_{1,12}$ | 1748 | (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=	78.15	69.39	74.07	68.06	67.9	62.4	61.57	65.3	64.47	70.49	72.45	76.83	(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=	90.37	90.37	90.37	90.37	90.37	90.37	90.37	90.37	90.37	90.37	90.37	90.37	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.51	12.89	10.48	7.93	5.93	5.01	5.41	7.03	9.44	11.98	13.99	14.91	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.55	159.19	155.07	146.3	135.23	124.82	117.87	116.23	120.35	129.12	140.2	150.6	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	-72.3	(71)

Water heating gains (Table 5)

(72)m=	105.04	103.26	99.56	94.53	91.26	86.67	82.76	87.77	89.54	94.75	100.63	103.27	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	327.21	325.44	315.22	298.87	282.53	266.6	256.15	261.14	269.45	285.97	304.92	318.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(76)
East	0.9x 0.77	x	3.82	x	19.64	x	0.63	x	0.7	=	22.93	(76)
East	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(76)
East	0.9x 0.77	x	3.82	x	38.42	x	0.63	x	0.7	=	44.85	(76)
East	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(76)
East	0.9x 0.77	x	3.82	x	63.27	x	0.63	x	0.7	=	73.87	(76)
East	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(76)
East	0.9x 0.77	x	3.82	x	92.28	x	0.63	x	0.7	=	107.73	(76)
East	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(76)
East	0.9x 0.77	x	3.82	x	113.09	x	0.63	x	0.7	=	132.03	(76)
East	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(76)
East	0.9x 0.77	x	3.82	x	115.77	x	0.63	x	0.7	=	135.16	(76)
East	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(76)
East	0.9x 0.77	x	3.82	x	110.22	x	0.63	x	0.7	=	128.67	(76)
East	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(76)
East	0.9x 0.77	x	3.82	x	94.68	x	0.63	x	0.7	=	110.53	(76)
East	0.9x 0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(76)
East	0.9x 0.77	x	3.82	x	73.59	x	0.63	x	0.7	=	85.91	(76)
East	0.9x 0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(76)
East	0.9x 0.77	x	3.82	x	45.59	x	0.63	x	0.7	=	53.22	(76)
East	0.9x 0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(76)
East	0.9x 0.77	x	3.82	x	24.49	x	0.63	x	0.7	=	28.59	(76)
East	0.9x 0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(76)
East	0.9x 0.77	x	3.82	x	16.15	x	0.63	x	0.7	=	18.86	(76)
West	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x 0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x 0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x 0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x 0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x 0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x 0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x 0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x 0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)

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West	0.9x	0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	54.62	106.85	175.97	256.64	314.52	321.97	306.53	263.3	204.66	126.79	68.11	44.92	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	381.83	432.3	491.19	555.51	597.05	588.57	562.67	524.44	474.11	412.76	373.03	363.81	(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=	0.97	0.96	0.92	0.84	0.7	0.53	0.39	0.44	0.67	0.88	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.59	19.8	20.14	20.55	20.82	20.95	20.99	20.98	20.89	20.51	19.99	19.55	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.11	20.11	20.13	20.13	20.13	20.12	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.95	0.91	0.81	0.65	0.47	0.32	0.36	0.6	0.86	0.95	0.97	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.21	18.52	19.01	19.57	19.93	20.09	20.12	20.12	20.02	19.54	18.8	18.17	(90)

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.85	19.11	19.53	20.02	20.34	20.49	20.52	20.52	20.42	19.99	19.35	18.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.85	19.11	19.53	20.02	20.34	20.49	20.52	20.52	20.42	19.99	19.35	18.81	(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=	0.96	0.94	0.9	0.81	0.67	0.49	0.35	0.39	0.63	0.85	0.94	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	367.35	407.28	441.35	448.4	398.21	289.8	198.37	206.5	296.61	351.56	351.02	351.87	(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=	774.38	754.05	689.48	579.93	449.23	301.69	200.9	210.35	325.9	488.4	640.59	768.59	(97)

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	302.83	233.03	184.61	94.7	37.96	0	0	0	0	101.81	208.49	310.04

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1473.46 (98)

Space heating requirement in kWh/m²/year 27.3 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1473.46

Space heat from Community boilers (98) x (304a) x (305) x (306) = 1547.13 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1748

If DHW from community scheme:

Water heat from Community boilers (64) x (303a) x (305) x (306) = 1835.4 (310a)

Electricity used for heat distribution 0.01 × [(307a)...(307e) + (310a)...(310e)] = 33.83 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside 115.58 (330a)

warm air heating system fans 0 (330b)

pump for solar water heating 0 (330g)

Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 115.58 (331)

Energy for lighting (calculated in Appendix L) 256.23 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 3754.34 (338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel 91 (367a)

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CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	802.89	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	17.56	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	820.44	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			820.44	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	59.98	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	132.98	(379)
Total CO2, kg/year	sum of (376)…(382) =			1013.41	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.77	(384)
EI rating (section 14)				86.28	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Garden House

Address : Garden_House

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	146.84	(1a) x	3.8	(2a) =	557.99	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	146.84	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		557.99	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				3 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15 (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) =		0.13 (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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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			1.18	x1/[1/(1.4)+ 0.04] =	1.56			(27)
Windows Type 2			4.37	x1/[1/(1.4)+ 0.04] =	5.79			(27)
Windows Type 3			1.18	x1/[1/(1.4)+ 0.04] =	1.56			(27)
Windows Type 4			1.43	x1/[1/(1.4)+ 0.04] =	1.9			(27)
Windows Type 5			1.43	x1/[1/(1.4)+ 0.04] =	1.9			(27)
Windows Type 6			4.2	x1/[1/(1.4)+ 0.04] =	5.57			(27)
Windows Type 7			3.52	x1/[1/(1.4)+ 0.04] =	4.67			(27)
Windows Type 8			1.61	x1/[1/(1.4)+ 0.04] =	2.13			(27)
Windows Type 9			3.84	x1/[1/(1.4)+ 0.04] =	5.09			(27)
Windows Type 10			2.9	x1/[1/(1.4)+ 0.04] =	3.84			(27)
Windows Type 11			2.18	x1/[1/(1.4)+ 0.04] =	2.89			(27)
Windows Type 12			4.2	x1/[1/(1.4)+ 0.04] =	5.57			(27)
Windows Type 13			4.2	x1/[1/(1.4)+ 0.04] =	5.57			(27)
Windows Type 14			3.91	x1/[1/(1.4)+ 0.04] =	5.18			(27)
Windows Type 15			2.9	x1/[1/(1.4)+ 0.04] =	3.84			(27)
Windows Type 16			3.52	x1/[1/(1.4)+ 0.04] =	4.67			(27)
Windows Type 17			4.2	x1/[1/(1.4)+ 0.04] =	5.57			(27)
Windows Type 18			4.74	x1/[1/(1.4)+ 0.04] =	6.28			(27)
Floor			146.84	x 0.12 =	17.6208	110	16152.4	(28)

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Walls	173.72	55.51	118.21	x	0.18	=	21.28	70	8274.7 (29)
Roof	169.3	0	169.3	x	0.1	=	16.93	9	1523.7 (30)
Total area of elements, m²			489.86						(31)
Internal wall **			150					9	1350 (32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 129.42 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 27300.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 185.92 (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 31.39 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 160.81 (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=	52.35	51.77	51.18	48.24	47.66	44.72	44.72	44.14	45.9	47.66	48.83	50	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	213.16	212.57	211.99	209.05	208.47	205.53	205.53	204.94	206.7	208.47	209.64	210.81	

Average = Sum(39)$_{1...12}$ /12= 208.91 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.45	1.45	1.44	1.42	1.42	1.4	1.4	1.4	1.41	1.42	1.43	1.44	

Average = Sum(40)$_{1...12}$ /12= 1.42 (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)

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4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.93 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 103.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	114.14	109.99	105.84	101.69	97.54	93.39	93.39	97.54	101.69	105.84	109.99	114.14	

Total = Sum(44)$_{1...12}$ = 1245.2 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	169.27	148.05	152.77	133.19	127.8	110.28	102.19	117.27	118.67	138.29	150.96	163.93	

Total = Sum(45)$_{1...12}$ = 1632.66 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.39	22.21	22.92	19.98	19.17	16.54	15.33	17.59	17.8	20.74	22.64	24.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

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If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	110	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02	(51)
If community heating see section 4.3			
Volume factor from Table 2a		1.03	(52)
Temperature factor from Table 2b		0.6	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.03	(54)
Enter (50) or (54) in (55)		1.03	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	224.55	197.97	208.05	186.68	183.07	163.77	157.47	172.54	172.16	193.57	204.45	219.21	(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=	224.55	197.97	208.05	186.68	183.07	163.77	157.47	172.54	172.16	193.57	204.45	219.21	

Output from water heater (annual)$_{1...12}$: 2283.5 (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=	100.5	89.17	95.02	87.08	86.71	79.46	78.2	83.21	82.25	90.2	92.99	98.73	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	146.46	146.46	146.46	146.46	146.46	146.46	146.46	146.46	146.46	146.46	146.46	146.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	28.27	25.11	20.42	15.46	11.55	9.75	10.54	13.7	18.39	23.35	27.25	29.05	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	317.06	320.35	312.06	294.41	272.13	251.19	237.2	233.91	242.2	259.85	282.13	303.07	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

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(69)m=	37.65	37.65	37.65	37.65	37.65	37.65	37.65	37.65	37.65	37.65	37.65	37.65	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17	(71)

Water heating gains (Table 5)

(72)m=	135.09	132.69	127.71	120.94	116.55	110.37	105.11	111.84	114.24	121.24	129.15	132.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	547.35	545.09	527.13	497.75	467.17	438.25	419.79	426.39	441.77	471.38	505.47	531.76	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	1.18	x	11.28	x	0.63	x	0.7	=	4.07	(75)
Northeast 0.9x	0.77	x	1.18	x	11.28	x	0.63	x	0.7	=	4.07	(75)
Northeast 0.9x	0.77	x	3.52	x	11.28	x	0.63	x	0.7	=	12.14	(75)
Northeast 0.9x	0.77	x	3.84	x	11.28	x	0.63	x	0.7	=	13.24	(75)
Northeast 0.9x	0.77	x	3.52	x	11.28	x	0.63	x	0.7	=	12.14	(75)
Northeast 0.9x	0.77	x	1.18	x	22.97	x	0.63	x	0.7	=	8.28	(75)
Northeast 0.9x	0.77	x	1.18	x	22.97	x	0.63	x	0.7	=	8.28	(75)
Northeast 0.9x	0.77	x	3.52	x	22.97	x	0.63	x	0.7	=	24.71	(75)
Northeast 0.9x	0.77	x	3.84	x	22.97	x	0.63	x	0.7	=	26.95	(75)
Northeast 0.9x	0.77	x	3.52	x	22.97	x	0.63	x	0.7	=	24.71	(75)
Northeast 0.9x	0.77	x	1.18	x	41.38	x	0.63	x	0.7	=	14.92	(75)
Northeast 0.9x	0.77	x	1.18	x	41.38	x	0.63	x	0.7	=	14.92	(75)
Northeast 0.9x	0.77	x	3.52	x	41.38	x	0.63	x	0.7	=	44.51	(75)
Northeast 0.9x	0.77	x	3.84	x	41.38	x	0.63	x	0.7	=	48.56	(75)
Northeast 0.9x	0.77	x	3.52	x	41.38	x	0.63	x	0.7	=	44.51	(75)
Northeast 0.9x	0.77	x	1.18	x	67.96	x	0.63	x	0.7	=	24.51	(75)
Northeast 0.9x	0.77	x	1.18	x	67.96	x	0.63	x	0.7	=	24.51	(75)
Northeast 0.9x	0.77	x	3.52	x	67.96	x	0.63	x	0.7	=	73.1	(75)
Northeast 0.9x	0.77	x	3.84	x	67.96	x	0.63	x	0.7	=	79.75	(75)
Northeast 0.9x	0.77	x	3.52	x	67.96	x	0.63	x	0.7	=	73.1	(75)
Northeast 0.9x	0.77	x	1.18	x	91.35	x	0.63	x	0.7	=	32.94	(75)
Northeast 0.9x	0.77	x	1.18	x	91.35	x	0.63	x	0.7	=	32.94	(75)
Northeast 0.9x	0.77	x	3.52	x	91.35	x	0.63	x	0.7	=	98.27	(75)
Northeast 0.9x	0.77	x	3.84	x	91.35	x	0.63	x	0.7	=	107.2	(75)
Northeast 0.9x	0.77	x	3.52	x	91.35	x	0.63	x	0.7	=	98.27	(75)
Northeast 0.9x	0.77	x	1.18	x	97.38	x	0.63	x	0.7	=	35.12	(75)
Northeast 0.9x	0.77	x	1.18	x	97.38	x	0.63	x	0.7	=	35.12	(75)
Northeast 0.9x	0.77	x	3.52	x	97.38	x	0.63	x	0.7	=	104.76	(75)

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Northeast	0.9x	0.77	x	3.84	x	97.38	x	0.63	x	0.7	=	114.29	(75)
Northeast	0.9x	0.77	x	3.52	x	97.38	x	0.63	x	0.7	=	104.76	(75)
Northeast	0.9x	0.77	x	1.18	x	91.1	x	0.63	x	0.7	=	32.85	(75)
Northeast	0.9x	0.77	x	1.18	x	91.1	x	0.63	x	0.7	=	32.85	(75)
Northeast	0.9x	0.77	x	3.52	x	91.1	x	0.63	x	0.7	=	98	(75)
Northeast	0.9x	0.77	x	3.84	x	91.1	x	0.63	x	0.7	=	106.91	(75)
Northeast	0.9x	0.77	x	3.52	x	91.1	x	0.63	x	0.7	=	98	(75)
Northeast	0.9x	0.77	x	1.18	x	72.63	x	0.63	x	0.7	=	26.19	(75)
Northeast	0.9x	0.77	x	1.18	x	72.63	x	0.63	x	0.7	=	26.19	(75)
Northeast	0.9x	0.77	x	3.52	x	72.63	x	0.63	x	0.7	=	78.13	(75)
Northeast	0.9x	0.77	x	3.84	x	72.63	x	0.63	x	0.7	=	85.23	(75)
Northeast	0.9x	0.77	x	3.52	x	72.63	x	0.63	x	0.7	=	78.13	(75)
Northeast	0.9x	0.77	x	1.18	x	50.42	x	0.63	x	0.7	=	18.18	(75)
Northeast	0.9x	0.77	x	1.18	x	50.42	x	0.63	x	0.7	=	18.18	(75)
Northeast	0.9x	0.77	x	3.52	x	50.42	x	0.63	x	0.7	=	54.24	(75)
Northeast	0.9x	0.77	x	3.84	x	50.42	x	0.63	x	0.7	=	59.17	(75)
Northeast	0.9x	0.77	x	3.52	x	50.42	x	0.63	x	0.7	=	54.24	(75)
Northeast	0.9x	0.77	x	1.18	x	28.07	x	0.63	x	0.7	=	10.12	(75)
Northeast	0.9x	0.77	x	1.18	x	28.07	x	0.63	x	0.7	=	10.12	(75)
Northeast	0.9x	0.77	x	3.52	x	28.07	x	0.63	x	0.7	=	30.19	(75)
Northeast	0.9x	0.77	x	3.84	x	28.07	x	0.63	x	0.7	=	32.94	(75)
Northeast	0.9x	0.77	x	3.52	x	28.07	x	0.63	x	0.7	=	30.19	(75)
Northeast	0.9x	0.77	x	1.18	x	14.2	x	0.63	x	0.7	=	5.12	(75)
Northeast	0.9x	0.77	x	1.18	x	14.2	x	0.63	x	0.7	=	5.12	(75)
Northeast	0.9x	0.77	x	3.52	x	14.2	x	0.63	x	0.7	=	15.27	(75)
Northeast	0.9x	0.77	x	3.84	x	14.2	x	0.63	x	0.7	=	16.66	(75)
Northeast	0.9x	0.77	x	3.52	x	14.2	x	0.63	x	0.7	=	15.27	(75)
Northeast	0.9x	0.77	x	1.18	x	9.21	x	0.63	x	0.7	=	3.32	(75)
Northeast	0.9x	0.77	x	1.18	x	9.21	x	0.63	x	0.7	=	3.32	(75)
Northeast	0.9x	0.77	x	3.52	x	9.21	x	0.63	x	0.7	=	9.91	(75)
Northeast	0.9x	0.77	x	3.84	x	9.21	x	0.63	x	0.7	=	10.81	(75)
Northeast	0.9x	0.77	x	3.52	x	9.21	x	0.63	x	0.7	=	9.91	(75)
Southeast	0.9x	0.77	x	4.37	x	36.79	x	0.63	x	0.7	=	49.14	(77)
Southeast	0.9x	0.77	x	2.9	x	36.79	x	0.63	x	0.7	=	32.61	(77)
Southeast	0.9x	0.77	x	4.37	x	62.67	x	0.63	x	0.7	=	83.7	(77)
Southeast	0.9x	0.77	x	2.9	x	62.67	x	0.63	x	0.7	=	55.55	(77)
Southeast	0.9x	0.77	x	4.37	x	85.75	x	0.63	x	0.7	=	114.53	(77)
Southeast	0.9x	0.77	x	2.9	x	85.75	x	0.63	x	0.7	=	76	(77)
Southeast	0.9x	0.77	x	4.37	x	106.25	x	0.63	x	0.7	=	141.9	(77)
Southeast	0.9x	0.77	x	2.9	x	106.25	x	0.63	x	0.7	=	94.17	(77)
Southeast	0.9x	0.77	x	4.37	x	119.01	x	0.63	x	0.7	=	158.94	(77)

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Southeast	0.9x	0.77	x	2.9	x	119.01	x	0.63	x	0.7	=	105.48	(77)
Southeast	0.9x	0.77	x	4.37	x	118.15	x	0.63	x	0.7	=	157.79	(77)
Southeast	0.9x	0.77	x	2.9	x	118.15	x	0.63	x	0.7	=	104.71	(77)
Southeast	0.9x	0.77	x	4.37	x	113.91	x	0.63	x	0.7	=	152.13	(77)
Southeast	0.9x	0.77	x	2.9	x	113.91	x	0.63	x	0.7	=	100.96	(77)
Southeast	0.9x	0.77	x	4.37	x	104.39	x	0.63	x	0.7	=	139.42	(77)
Southeast	0.9x	0.77	x	2.9	x	104.39	x	0.63	x	0.7	=	92.52	(77)
Southeast	0.9x	0.77	x	4.37	x	92.85	x	0.63	x	0.7	=	124.01	(77)
Southeast	0.9x	0.77	x	2.9	x	92.85	x	0.63	x	0.7	=	82.29	(77)
Southeast	0.9x	0.77	x	4.37	x	69.27	x	0.63	x	0.7	=	92.51	(77)
Southeast	0.9x	0.77	x	2.9	x	69.27	x	0.63	x	0.7	=	61.39	(77)
Southeast	0.9x	0.77	x	4.37	x	44.07	x	0.63	x	0.7	=	58.86	(77)
Southeast	0.9x	0.77	x	2.9	x	44.07	x	0.63	x	0.7	=	39.06	(77)
Southeast	0.9x	0.77	x	4.37	x	31.49	x	0.63	x	0.7	=	42.05	(77)
Southeast	0.9x	0.77	x	2.9	x	31.49	x	0.63	x	0.7	=	27.91	(77)
Southwest	0.9x	0.77	x	1.61	x	36.79		0.63	x	0.7	=	18.1	(79)
Southwest	0.9x	0.77	x	2.9	x	36.79		0.63	x	0.7	=	32.61	(79)
Southwest	0.9x	0.77	x	2.18	x	36.79		0.63	x	0.7	=	24.51	(79)
Southwest	0.9x	0.77	x	4.2	x	36.79		0.63	x	0.7	=	47.23	(79)
Southwest	0.9x	0.77	x	4.2	x	36.79		0.63	x	0.7	=	47.23	(79)
Southwest	0.9x	0.77	x	3.91	x	36.79		0.63	x	0.7	=	43.97	(79)
Southwest	0.9x	0.77	x	4.2	x	36.79		0.63	x	0.7	=	47.23	(79)
Southwest	0.9x	0.77	x	1.61	x	62.67		0.63	x	0.7	=	30.84	(79)
Southwest	0.9x	0.77	x	2.9	x	62.67		0.63	x	0.7	=	55.55	(79)
Southwest	0.9x	0.77	x	2.18	x	62.67		0.63	x	0.7	=	41.76	(79)
Southwest	0.9x	0.77	x	4.2	x	62.67		0.63	x	0.7	=	80.45	(79)
Southwest	0.9x	0.77	x	4.2	x	62.67		0.63	x	0.7	=	80.45	(79)
Southwest	0.9x	0.77	x	3.91	x	62.67		0.63	x	0.7	=	74.89	(79)
Southwest	0.9x	0.77	x	4.2	x	62.67		0.63	x	0.7	=	80.45	(79)
Southwest	0.9x	0.77	x	1.61	x	85.75		0.63	x	0.7	=	42.19	(79)
Southwest	0.9x	0.77	x	2.9	x	85.75		0.63	x	0.7	=	76	(79)
Southwest	0.9x	0.77	x	2.18	x	85.75		0.63	x	0.7	=	57.13	(79)
Southwest	0.9x	0.77	x	4.2	x	85.75		0.63	x	0.7	=	110.07	(79)
Southwest	0.9x	0.77	x	4.2	x	85.75		0.63	x	0.7	=	110.07	(79)
Southwest	0.9x	0.77	x	3.91	x	85.75		0.63	x	0.7	=	102.47	(79)
Southwest	0.9x	0.77	x	4.2	x	85.75		0.63	x	0.7	=	110.07	(79)
Southwest	0.9x	0.77	x	1.61	x	106.25		0.63	x	0.7	=	52.28	(79)
Southwest	0.9x	0.77	x	2.9	x	106.25		0.63	x	0.7	=	94.17	(79)
Southwest	0.9x	0.77	x	2.18	x	106.25		0.63	x	0.7	=	70.79	(79)
Southwest	0.9x	0.77	x	4.2	x	106.25		0.63	x	0.7	=	136.38	(79)
Southwest	0.9x	0.77	x	4.2	x	106.25		0.63	x	0.7	=	136.38	(79)

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Southwest	0.9x	0.77	x	3.91	x	106.25		0.63	x	0.7	=	126.97		(79)
Southwest	0.9x	0.77	x	4.2	x	106.25		0.63	x	0.7	=	136.38		(79)
Southwest	0.9x	0.77	x	1.61	x	119.01		0.63	x	0.7	=	58.56		(79)
Southwest	0.9x	0.77	x	2.9	x	119.01		0.63	x	0.7	=	105.48		(79)
Southwest	0.9x	0.77	x	2.18	x	119.01		0.63	x	0.7	=	79.29		(79)
Southwest	0.9x	0.77	x	4.2	x	119.01		0.63	x	0.7	=	152.76		(79)
Southwest	0.9x	0.77	x	4.2	x	119.01		0.63	x	0.7	=	152.76		(79)
Southwest	0.9x	0.77	x	3.91	x	119.01		0.63	x	0.7	=	142.21		(79)
Southwest	0.9x	0.77	x	4.2	x	119.01		0.63	x	0.7	=	152.76		(79)
Southwest	0.9x	0.77	x	1.61	x	118.15		0.63	x	0.7	=	58.13		(79)
Southwest	0.9x	0.77	x	2.9	x	118.15		0.63	x	0.7	=	104.71		(79)
Southwest	0.9x	0.77	x	2.18	x	118.15		0.63	x	0.7	=	78.72		(79)
Southwest	0.9x	0.77	x	4.2	x	118.15		0.63	x	0.7	=	151.65		(79)
Southwest	0.9x	0.77	x	4.2	x	118.15		0.63	x	0.7	=	151.65		(79)
Southwest	0.9x	0.77	x	3.91	x	118.15		0.63	x	0.7	=	141.18		(79)
Southwest	0.9x	0.77	x	4.2	x	118.15		0.63	x	0.7	=	151.65		(79)
Southwest	0.9x	0.77	x	1.61	x	113.91		0.63	x	0.7	=	56.05		(79)
Southwest	0.9x	0.77	x	2.9	x	113.91		0.63	x	0.7	=	100.96		(79)
Southwest	0.9x	0.77	x	2.18	x	113.91		0.63	x	0.7	=	75.89		(79)
Southwest	0.9x	0.77	x	4.2	x	113.91		0.63	x	0.7	=	146.21		(79)
Southwest	0.9x	0.77	x	4.2	x	113.91		0.63	x	0.7	=	146.21		(79)
Southwest	0.9x	0.77	x	3.91	x	113.91		0.63	x	0.7	=	136.12		(79)
Southwest	0.9x	0.77	x	4.2	x	113.91		0.63	x	0.7	=	146.21		(79)
Southwest	0.9x	0.77	x	1.61	x	104.39		0.63	x	0.7	=	51.36		(79)
Southwest	0.9x	0.77	x	2.9	x	104.39		0.63	x	0.7	=	92.52		(79)
Southwest	0.9x	0.77	x	2.18	x	104.39		0.63	x	0.7	=	69.55		(79)
Southwest	0.9x	0.77	x	4.2	x	104.39		0.63	x	0.7	=	133.99		(79)
Southwest	0.9x	0.77	x	4.2	x	104.39		0.63	x	0.7	=	133.99		(79)
Southwest	0.9x	0.77	x	3.91	x	104.39		0.63	x	0.7	=	124.74		(79)
Southwest	0.9x	0.77	x	4.2	x	104.39		0.63	x	0.7	=	133.99		(79)
Southwest	0.9x	0.77	x	1.61	x	92.85		0.63	x	0.7	=	45.69		(79)
Southwest	0.9x	0.77	x	2.9	x	92.85		0.63	x	0.7	=	82.29		(79)
Southwest	0.9x	0.77	x	2.18	x	92.85		0.63	x	0.7	=	61.86		(79)
Southwest	0.9x	0.77	x	4.2	x	92.85		0.63	x	0.7	=	119.18		(79)
Southwest	0.9x	0.77	x	4.2	x	92.85		0.63	x	0.7	=	119.18		(79)
Southwest	0.9x	0.77	x	3.91	x	92.85		0.63	x	0.7	=	110.95		(79)
Southwest	0.9x	0.77	x	4.2	x	92.85		0.63	x	0.7	=	119.18		(79)
Southwest	0.9x	0.77	x	1.61	x	69.27		0.63	x	0.7	=	34.08		(79)
Southwest	0.9x	0.77	x	2.9	x	69.27		0.63	x	0.7	=	61.39		(79)
Southwest	0.9x	0.77	x	2.18	x	69.27		0.63	x	0.7	=	46.15		(79)
Southwest	0.9x	0.77	x	4.2	x	69.27		0.63	x	0.7	=	88.91		(79)

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Southwest	0.9x	0.77	x	4.2	x	69.27		0.63	x	0.7	=	88.91		(79)
Southwest	0.9x	0.77	x	3.91	x	69.27		0.63	x	0.7	=	82.77		(79)
Southwest	0.9x	0.77	x	4.2	x	69.27		0.63	x	0.7	=	88.91		(79)
Southwest	0.9x	0.77	x	1.61	x	44.07		0.63	x	0.7	=	21.68		(79)
Southwest	0.9x	0.77	x	2.9	x	44.07		0.63	x	0.7	=	39.06		(79)
Southwest	0.9x	0.77	x	2.18	x	44.07		0.63	x	0.7	=	29.36		(79)
Southwest	0.9x	0.77	x	4.2	x	44.07		0.63	x	0.7	=	56.57		(79)
Southwest	0.9x	0.77	x	4.2	x	44.07		0.63	x	0.7	=	56.57		(79)
Southwest	0.9x	0.77	x	3.91	x	44.07		0.63	x	0.7	=	52.66		(79)
Southwest	0.9x	0.77	x	4.2	x	44.07		0.63	x	0.7	=	56.57		(79)
Southwest	0.9x	0.77	x	1.61	x	31.49		0.63	x	0.7	=	15.49		(79)
Southwest	0.9x	0.77	x	2.9	x	31.49		0.63	x	0.7	=	27.91		(79)
Southwest	0.9x	0.77	x	2.18	x	31.49		0.63	x	0.7	=	20.98		(79)
Southwest	0.9x	0.77	x	4.2	x	31.49		0.63	x	0.7	=	40.42		(79)
Southwest	0.9x	0.77	x	4.2	x	31.49		0.63	x	0.7	=	40.42		(79)
Southwest	0.9x	0.77	x	3.91	x	31.49		0.63	x	0.7	=	37.63		(79)
Southwest	0.9x	0.77	x	4.2	x	31.49		0.63	x	0.7	=	40.42		(79)
Northwest	0.9x	0.77	x	1.43	x	11.28	x	0.63	x	0.7	=	4.93		(81)
Northwest	0.9x	0.77	x	1.43	x	11.28	x	0.63	x	0.7	=	4.93		(81)
Northwest	0.9x	0.77	x	4.2	x	11.28	x	0.63	x	0.7	=	14.48		(81)
Northwest	0.9x	0.77	x	4.74	x	11.28	x	0.63	x	0.7	=	16.34		(81)
Northwest	0.9x	0.77	x	1.43	x	22.97	x	0.63	x	0.7	=	10.04		(81)
Northwest	0.9x	0.77	x	1.43	x	22.97	x	0.63	x	0.7	=	10.04		(81)
Northwest	0.9x	0.77	x	4.2	x	22.97	x	0.63	x	0.7	=	29.48		(81)
Northwest	0.9x	0.77	x	4.74	x	22.97	x	0.63	x	0.7	=	33.27		(81)
Northwest	0.9x	0.77	x	1.43	x	41.38	x	0.63	x	0.7	=	18.08		(81)
Northwest	0.9x	0.77	x	1.43	x	41.38	x	0.63	x	0.7	=	18.08		(81)
Northwest	0.9x	0.77	x	4.2	x	41.38	x	0.63	x	0.7	=	53.11		(81)
Northwest	0.9x	0.77	x	4.74	x	41.38	x	0.63	x	0.7	=	59.94		(81)
Northwest	0.9x	0.77	x	1.43	x	67.96	x	0.63	x	0.7	=	29.7		(81)
Northwest	0.9x	0.77	x	1.43	x	67.96	x	0.63	x	0.7	=	29.7		(81)
Northwest	0.9x	0.77	x	4.2	x	67.96	x	0.63	x	0.7	=	87.23		(81)
Northwest	0.9x	0.77	x	4.74	x	67.96	x	0.63	x	0.7	=	98.44		(81)
Northwest	0.9x	0.77	x	1.43	x	91.35	x	0.63	x	0.7	=	39.92		(81)
Northwest	0.9x	0.77	x	1.43	x	91.35	x	0.63	x	0.7	=	39.92		(81)
Northwest	0.9x	0.77	x	4.2	x	91.35	x	0.63	x	0.7	=	117.25		(81)
Northwest	0.9x	0.77	x	4.74	x	91.35	x	0.63	x	0.7	=	132.32		(81)
Northwest	0.9x	0.77	x	1.43	x	97.38	x	0.63	x	0.7	=	42.56		(81)
Northwest	0.9x	0.77	x	1.43	x	97.38	x	0.63	x	0.7	=	42.56		(81)
Northwest	0.9x	0.77	x	4.2	x	97.38	x	0.63	x	0.7	=	125		(81)
Northwest	0.9x	0.77	x	4.74	x	97.38	x	0.63	x	0.7	=	141.07		(81)

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Northwest	0.9x	0.77	x	1.43	x	91.1	x	0.63	x	0.7	=	39.81		(81)
Northwest	0.9x	0.77	x	1.43	x	91.1	x	0.63	x	0.7	=	39.81		(81)
Northwest	0.9x	0.77	x	4.2	x	91.1	x	0.63	x	0.7	=	116.94		(81)
Northwest	0.9x	0.77	x	4.74	x	91.1	x	0.63	x	0.7	=	131.97		(81)
Northwest	0.9x	0.77	x	1.43	x	72.63	x	0.63	x	0.7	=	31.74		(81)
Northwest	0.9x	0.77	x	1.43	x	72.63	x	0.63	x	0.7	=	31.74		(81)
Northwest	0.9x	0.77	x	4.2	x	72.63	x	0.63	x	0.7	=	93.22		(81)
Northwest	0.9x	0.77	x	4.74	x	72.63	x	0.63	x	0.7	=	105.21		(81)
Northwest	0.9x	0.77	x	1.43	x	50.42	x	0.63	x	0.7	=	22.04		(81)
Northwest	0.9x	0.77	x	1.43	x	50.42	x	0.63	x	0.7	=	22.04		(81)
Northwest	0.9x	0.77	x	4.2	x	50.42	x	0.63	x	0.7	=	64.72		(81)
Northwest	0.9x	0.77	x	4.74	x	50.42	x	0.63	x	0.7	=	73.04		(81)
Northwest	0.9x	0.77	x	1.43	x	28.07	x	0.63	x	0.7	=	12.27		(81)
Northwest	0.9x	0.77	x	1.43	x	28.07	x	0.63	x	0.7	=	12.27		(81)
Northwest	0.9x	0.77	x	4.2	x	28.07	x	0.63	x	0.7	=	36.03		(81)
Northwest	0.9x	0.77	x	4.74	x	28.07	x	0.63	x	0.7	=	40.66		(81)
Northwest	0.9x	0.77	x	1.43	x	14.2	x	0.63	x	0.7	=	6.2		(81)
Northwest	0.9x	0.77	x	1.43	x	14.2	x	0.63	x	0.7	=	6.2		(81)
Northwest	0.9x	0.77	x	4.2	x	14.2	x	0.63	x	0.7	=	18.22		(81)
Northwest	0.9x	0.77	x	4.74	x	14.2	x	0.63	x	0.7	=	20.57		(81)
Northwest	0.9x	0.77	x	1.43	x	9.21	x	0.63	x	0.7	=	4.03		(81)
Northwest	0.9x	0.77	x	1.43	x	9.21	x	0.63	x	0.7	=	4.03		(81)
Northwest	0.9x	0.77	x	4.2	x	9.21	x	0.63	x	0.7	=	11.83		(81)
Northwest	0.9x	0.77	x	4.74	x	9.21	x	0.63	x	0.7	=	13.35		(81)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	428.97	759.37	1115.18	1509.45	1807.26	1845.46	1757.88	1527.87	1250.49	859.81	519.03	363.73	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	976.32	1304.46	1642.31	2007.2	2274.43	2283.7	2177.67	1954.26	1692.25	1331.19	1024.5	895.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.85	0.71	0.54	0.4	0.46	0.7	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.05	19.39	19.85	20.38	20.75	20.93	20.98	20.97	20.82	20.29	19.56	19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.72	19.73	19.73	19.75	19.75	19.76	19.76	19.77	19.76	19.75	19.74	19.74	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.82	0.65	0.45	0.3	0.35	0.62	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	17.17	17.65	18.31	19.05	19.52	19.72	19.76	19.75	19.62	18.95	17.92	17.1	(90)

fLA = Living area ÷ (4) = 0.39 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.91	18.34	18.92	19.58	20	20.2	20.24	20.23	20.09	19.48	18.57	17.85	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.91	18.34	18.92	19.58	20	20.2	20.24	20.23	20.09	19.48	18.57	17.85	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.91	0.81	0.66	0.48	0.34	0.39	0.64	0.88	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	959.73	1252.59	1499.23	1631.76	1499.65	1094.49	735.75	765.35	1087.88	1173.58	991.71	883.75	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2902.17	2856.21	2633.19	2232.6	1731.24	1150.35	748.03	785.64	1239.03	1850.36	2403.96	2878.3	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1445.17	1077.63	843.66	432.6	172.31	0	0	0	0	503.52	1016.82	1483.94	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 6975.66 (98)

Space heating requirement in kWh/m²/year 47.51 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		6975.66	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	7324.44	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement 2283.5

If DHW from community scheme:

Water heat from Community boilers (64) x (303a) x (305) x (306) = 2397.67 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 97.22 (313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		502.05	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	502.05	(331)
Energy for lighting (calculated in Appendix L)		499.19	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		10723.37	(338)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	2307.67	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	50.46	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	2358.13	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				2358.13	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	260.57	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	259.08	(379)
Total CO2, kg/year	sum of (376)…(382) =				2877.77	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				19.6	(384)
EI rating (section 14)					79.9	(385)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Lake View House

Address : Lake_View_House

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	132.5 (1a)	x	2.7 (2a)	=	357.75	(3a)
First floor	132.5 (1b)	x	2.4 (2b)	=	318	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	265 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	675.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				3 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15 (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) =			0.13 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			8.4	x1/[1/(1.4)+ 0.04] =			11.14			(27)
Windows Type 2			8.4	x1/[1/(1.4)+ 0.04] =			11.14			(27)
Windows Type 3			3.12	x1/[1/(1.4)+ 0.04] =			4.14			(27)
Windows Type 4			3.12	x1/[1/(1.4)+ 0.04] =			4.14			(27)
Windows Type 5			3.12	x1/[1/(1.4)+ 0.04] =			4.14			(27)
Windows Type 6			4.4	x1/[1/(1.4)+ 0.04] =			5.83			(27)
Windows Type 7			3.12	x1/[1/(1.4)+ 0.04] =			4.14			(27)
Windows Type 8			5.94	x1/[1/(1.4)+ 0.04] =			7.87			(27)
Windows Type 9			0.54	x1/[1/(1.4)+ 0.04] =			0.72			(27)
Windows Type 10			2.64	x1/[1/(1.4)+ 0.04] =			3.5			(27)
Windows Type 11			2.64	x1/[1/(1.4)+ 0.04] =			3.5			(27)
Windows Type 12			0.54	x1/[1/(1.4)+ 0.04] =			0.72			(27)
Windows Type 13			2.64	x1/[1/(1.4)+ 0.04] =			3.5			(27)
Floor			132.5	x	0.12	=	15.9	110	14575	(28)
Walls	270.61	48.62	221.99	x	0.18	=	39.96	70	15539.3	(29)
Roof	132.5	0	132.5	x	0.1	=	13.25	9	1192.5	(30)
Total area of elements, m²			535.61							(31)

DER WorkSheet: New dwelling design stage

Internal wall **	150	9	1350	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	133.57	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	32656.8	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	= (34) ÷ (4) =	123.23	(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		30.47	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	164.04	(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=	63.4	62.69	61.98	58.43	57.71	54.16	54.16	53.45	55.58	57.71	59.14	60.56	(38)

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

(39)m=	227.44	226.73	226.02	222.46	221.75	218.2	218.2	217.49	219.62	221.75	223.18	224.6	

Average = Sum(39)$_{1...12}$ /12= 222.29 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.84	0.84	0.82	0.82	0.82	0.83	0.84	0.84	0.85	

Average = Sum(40)$_{1...12}$ /12= 0.84 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 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	3.09	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 *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)*	107.5	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	118.25	113.95	109.65	105.35	101.05	96.75	96.75	101.05	105.35	109.65	113.95	118.25	

Total = Sum(44)$_{1...12}$ = 1290.03 (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=	175.37	153.38	158.27	137.98	132.4	114.25	105.87	121.49	122.94	143.27	156.39	169.83	

Total = Sum(45)$_{1...12}$ = 1691.44 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	26.3	23.01	23.74	20.7	19.86	17.14	15.88	18.22	18.44	21.49	23.46	25.47	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):	0	(48)
Temperature factor from Table 2b	0	(49)

Energy lost from water storage, kWh/year	(48) x (49) =	110	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02	(51)
If community heating see section 4.3			
Volume factor from Table 2a		1.03	(52)
Temperature factor from Table 2b		0.6	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.03	(54)
Enter (50) or (54) in (55)		1.03	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	230.64	203.3	213.55	191.48	187.68	167.74	161.15	176.76	176.43	198.55	209.89	225.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	230.64	203.3	213.55	191.48	187.68	167.74	161.15	176.76	176.43	198.55	209.89	225.11	

Output from water heater (annual)$_{1...12}$: 2342.28 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	102.53	90.94	96.85	88.67	88.24	80.78	79.42	84.62	83.67	91.86	94.8	100.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.32	154.32	154.32	154.32	154.32	154.32	154.32	154.32	154.32	154.32	154.32	154.32	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	38.97	34.61	28.15	21.31	15.93	13.45	14.53	18.89	25.35	32.19	37.57	40.05	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	429.26	433.72	422.49	398.6	368.43	340.08	321.14	316.68	327.91	351.81	381.97	410.32	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	38.43	38.43	38.43	38.43	38.43	38.43	38.43	38.43	38.43	38.43	38.43	38.43	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-123.46	-123.46	-123.46	-123.46	-123.46	-123.46	-123.46	-123.46	-123.46	-123.46	-123.46	-123.46	(71)

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DER WorkSheet: New dwelling design stage

Water heating gains (Table 5)

(72)m=	137.81	135.33	130.17	123.16	118.61	112.2	106.75	113.73	116.21	123.47	131.66	135.34	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	675.34	672.95	650.11	612.36	572.26	535.02	511.72	518.6	538.77	576.76	620.5	655.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	8.4	x	19.64	x	0.63	x	0.7	=	50.42	(76)
East	0.9x 0.77	x	8.4	x	19.64	x	0.63	x	0.7	=	50.42	(76)
East	0.9x 0.77	x	0.54	x	19.64	x	0.63	x	0.7	=	3.24	(76)
East	0.9x 0.77	x	2.64	x	19.64	x	0.63	x	0.7	=	15.85	(76)
East	0.9x 0.77	x	2.64	x	19.64	x	0.63	x	0.7	=	15.85	(76)
East	0.9x 0.77	x	0.54	x	19.64	x	0.63	x	0.7	=	3.24	(76)
East	0.9x 0.77	x	2.64	x	19.64	x	0.63	x	0.7	=	15.85	(76)
East	0.9x 0.77	x	8.4	x	38.42	x	0.63	x	0.7	=	98.63	(76)
East	0.9x 0.77	x	8.4	x	38.42	x	0.63	x	0.7	=	98.63	(76)
East	0.9x 0.77	x	0.54	x	38.42	x	0.63	x	0.7	=	6.34	(76)
East	0.9x 0.77	x	2.64	x	38.42	x	0.63	x	0.7	=	31	(76)
East	0.9x 0.77	x	2.64	x	38.42	x	0.63	x	0.7	=	31	(76)
East	0.9x 0.77	x	0.54	x	38.42	x	0.63	x	0.7	=	6.34	(76)
East	0.9x 0.77	x	2.64	x	38.42	x	0.63	x	0.7	=	31	(76)
East	0.9x 0.77	x	8.4	x	63.27	x	0.63	x	0.7	=	162.43	(76)
East	0.9x 0.77	x	8.4	x	63.27	x	0.63	x	0.7	=	162.43	(76)
East	0.9x 0.77	x	0.54	x	63.27	x	0.63	x	0.7	=	10.44	(76)
East	0.9x 0.77	x	2.64	x	63.27	x	0.63	x	0.7	=	51.05	(76)
East	0.9x 0.77	x	2.64	x	63.27	x	0.63	x	0.7	=	51.05	(76)
East	0.9x 0.77	x	0.54	x	63.27	x	0.63	x	0.7	=	10.44	(76)
East	0.9x 0.77	x	2.64	x	63.27	x	0.63	x	0.7	=	51.05	(76)
East	0.9x 0.77	x	8.4	x	92.28	x	0.63	x	0.7	=	236.9	(76)
East	0.9x 0.77	x	8.4	x	92.28	x	0.63	x	0.7	=	236.9	(76)
East	0.9x 0.77	x	0.54	x	92.28	x	0.63	x	0.7	=	15.23	(76)
East	0.9x 0.77	x	2.64	x	92.28	x	0.63	x	0.7	=	74.45	(76)
East	0.9x 0.77	x	2.64	x	92.28	x	0.63	x	0.7	=	74.45	(76)
East	0.9x 0.77	x	0.54	x	92.28	x	0.63	x	0.7	=	15.23	(76)
East	0.9x 0.77	x	2.64	x	92.28	x	0.63	x	0.7	=	74.45	(76)
East	0.9x 0.77	x	8.4	x	113.09	x	0.63	x	0.7	=	290.33	(76)
East	0.9x 0.77	x	8.4	x	113.09	x	0.63	x	0.7	=	290.33	(76)
East	0.9x 0.77	x	0.54	x	113.09	x	0.63	x	0.7	=	18.66	(76)
East	0.9x 0.77	x	2.64	x	113.09	x	0.63	x	0.7	=	91.25	(76)

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DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	2.64	x	113.09	x	0.63	x	0.7	=	91.25	(76)
East	0.9x	0.77	x	0.54	x	113.09	x	0.63	x	0.7	=	18.66	(76)
East	0.9x	0.77	x	2.64	x	113.09	x	0.63	x	0.7	=	91.25	(76)
East	0.9x	0.77	x	8.4	x	115.77	x	0.63	x	0.7	=	297.2	(76)
East	0.9x	0.77	x	8.4	x	115.77	x	0.63	x	0.7	=	297.2	(76)
East	0.9x	0.77	x	0.54	x	115.77	x	0.63	x	0.7	=	19.11	(76)
East	0.9x	0.77	x	2.64	x	115.77	x	0.63	x	0.7	=	93.41	(76)
East	0.9x	0.77	x	2.64	x	115.77	x	0.63	x	0.7	=	93.41	(76)
East	0.9x	0.77	x	0.54	x	115.77	x	0.63	x	0.7	=	19.11	(76)
East	0.9x	0.77	x	2.64	x	115.77	x	0.63	x	0.7	=	93.41	(76)
East	0.9x	0.77	x	8.4	x	110.22	x	0.63	x	0.7	=	282.95	(76)
East	0.9x	0.77	x	8.4	x	110.22	x	0.63	x	0.7	=	282.95	(76)
East	0.9x	0.77	x	0.54	x	110.22	x	0.63	x	0.7	=	18.19	(76)
East	0.9x	0.77	x	2.64	x	110.22	x	0.63	x	0.7	=	88.93	(76)
East	0.9x	0.77	x	2.64	x	110.22	x	0.63	x	0.7	=	88.93	(76)
East	0.9x	0.77	x	0.54	x	110.22	x	0.63	x	0.7	=	18.19	(76)
East	0.9x	0.77	x	2.64	x	110.22	x	0.63	x	0.7	=	88.93	(76)
East	0.9x	0.77	x	8.4	x	94.68	x	0.63	x	0.7	=	243.05	(76)
East	0.9x	0.77	x	8.4	x	94.68	x	0.63	x	0.7	=	243.05	(76)
East	0.9x	0.77	x	0.54	x	94.68	x	0.63	x	0.7	=	15.62	(76)
East	0.9x	0.77	x	2.64	x	94.68	x	0.63	x	0.7	=	76.39	(76)
East	0.9x	0.77	x	2.64	x	94.68	x	0.63	x	0.7	=	76.39	(76)
East	0.9x	0.77	x	0.54	x	94.68	x	0.63	x	0.7	=	15.62	(76)
East	0.9x	0.77	x	2.64	x	94.68	x	0.63	x	0.7	=	76.39	(76)
East	0.9x	0.77	x	8.4	x	73.59	x	0.63	x	0.7	=	188.91	(76)
East	0.9x	0.77	x	8.4	x	73.59	x	0.63	x	0.7	=	188.91	(76)
East	0.9x	0.77	x	0.54	x	73.59	x	0.63	x	0.7	=	12.14	(76)
East	0.9x	0.77	x	2.64	x	73.59	x	0.63	x	0.7	=	59.37	(76)
East	0.9x	0.77	x	2.64	x	73.59	x	0.63	x	0.7	=	59.37	(76)
East	0.9x	0.77	x	0.54	x	73.59	x	0.63	x	0.7	=	12.14	(76)
East	0.9x	0.77	x	2.64	x	73.59	x	0.63	x	0.7	=	59.37	(76)
East	0.9x	0.77	x	8.4	x	45.59	x	0.63	x	0.7	=	117.03	(76)
East	0.9x	0.77	x	8.4	x	45.59	x	0.63	x	0.7	=	117.03	(76)
East	0.9x	0.77	x	0.54	x	45.59	x	0.63	x	0.7	=	7.52	(76)
East	0.9x	0.77	x	2.64	x	45.59	x	0.63	x	0.7	=	36.78	(76)
East	0.9x	0.77	x	2.64	x	45.59	x	0.63	x	0.7	=	36.78	(76)
East	0.9x	0.77	x	0.54	x	45.59	x	0.63	x	0.7	=	7.52	(76)
East	0.9x	0.77	x	2.64	x	45.59	x	0.63	x	0.7	=	36.78	(76)
East	0.9x	0.77	x	8.4	x	24.49	x	0.63	x	0.7	=	62.87	(76)
East	0.9x	0.77	x	8.4	x	24.49	x	0.63	x	0.7	=	62.87	(76)
East	0.9x	0.77	x	0.54	x	24.49	x	0.63	x	0.7	=	4.04	(76)

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DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	2.64	x	24.49	x	0.63	x	0.7	=	19.76	(76)
East	0.9x	0.77	x	2.64	x	24.49	x	0.63	x	0.7	=	19.76	(76)
East	0.9x	0.77	x	0.54	x	24.49	x	0.63	x	0.7	=	4.04	(76)
East	0.9x	0.77	x	2.64	x	24.49	x	0.63	x	0.7	=	19.76	(76)
East	0.9x	0.77	x	8.4	x	16.15	x	0.63	x	0.7	=	41.46	(76)
East	0.9x	0.77	x	8.4	x	16.15	x	0.63	x	0.7	=	41.46	(76)
East	0.9x	0.77	x	0.54	x	16.15	x	0.63	x	0.7	=	2.67	(76)
East	0.9x	0.77	x	2.64	x	16.15	x	0.63	x	0.7	=	13.03	(76)
East	0.9x	0.77	x	2.64	x	16.15	x	0.63	x	0.7	=	13.03	(76)
East	0.9x	0.77	x	0.54	x	16.15	x	0.63	x	0.7	=	2.67	(76)
East	0.9x	0.77	x	2.64	x	16.15	x	0.63	x	0.7	=	13.03	(76)
West	0.9x	0.77	x	3.12	x	19.64	x	0.63	x	0.7	=	18.73	(80)
West	0.9x	0.77	x	3.12	x	19.64	x	0.63	x	0.7	=	18.73	(80)
West	0.9x	0.77	x	3.12	x	19.64	x	0.63	x	0.7	=	18.73	(80)
West	0.9x	0.77	x	4.4	x	19.64	x	0.63	x	0.7	=	26.41	(80)
West	0.9x	0.77	x	3.12	x	19.64	x	0.63	x	0.7	=	18.73	(80)
West	0.9x	0.77	x	5.94	x	19.64	x	0.63	x	0.7	=	35.65	(80)
West	0.9x	0.77	x	3.12	x	38.42	x	0.63	x	0.7	=	36.63	(80)
West	0.9x	0.77	x	3.12	x	38.42	x	0.63	x	0.7	=	36.63	(80)
West	0.9x	0.77	x	3.12	x	38.42	x	0.63	x	0.7	=	36.63	(80)
West	0.9x	0.77	x	4.4	x	38.42	x	0.63	x	0.7	=	51.66	(80)
West	0.9x	0.77	x	3.12	x	38.42	x	0.63	x	0.7	=	36.63	(80)
West	0.9x	0.77	x	5.94	x	38.42	x	0.63	x	0.7	=	69.75	(80)
West	0.9x	0.77	x	3.12	x	63.27	x	0.63	x	0.7	=	60.33	(80)
West	0.9x	0.77	x	3.12	x	63.27	x	0.63	x	0.7	=	60.33	(80)
West	0.9x	0.77	x	3.12	x	63.27	x	0.63	x	0.7	=	60.33	(80)
West	0.9x	0.77	x	4.4	x	63.27	x	0.63	x	0.7	=	85.08	(80)
West	0.9x	0.77	x	3.12	x	63.27	x	0.63	x	0.7	=	60.33	(80)
West	0.9x	0.77	x	5.94	x	63.27	x	0.63	x	0.7	=	114.86	(80)
West	0.9x	0.77	x	3.12	x	92.28	x	0.63	x	0.7	=	87.99	(80)
West	0.9x	0.77	x	3.12	x	92.28	x	0.63	x	0.7	=	87.99	(80)
West	0.9x	0.77	x	3.12	x	92.28	x	0.63	x	0.7	=	87.99	(80)
West	0.9x	0.77	x	4.4	x	92.28	x	0.63	x	0.7	=	124.09	(80)
West	0.9x	0.77	x	3.12	x	92.28	x	0.63	x	0.7	=	87.99	(80)
West	0.9x	0.77	x	5.94	x	92.28	x	0.63	x	0.7	=	167.52	(80)
West	0.9x	0.77	x	3.12	x	113.09	x	0.63	x	0.7	=	107.84	(80)
West	0.9x	0.77	x	3.12	x	113.09	x	0.63	x	0.7	=	107.84	(80)
West	0.9x	0.77	x	3.12	x	113.09	x	0.63	x	0.7	=	107.84	(80)
West	0.9x	0.77	x	4.4	x	113.09	x	0.63	x	0.7	=	152.08	(80)
West	0.9x	0.77	x	3.12	x	113.09	x	0.63	x	0.7	=	107.84	(80)
West	0.9x	0.77	x	5.94	x	113.09	x	0.63	x	0.7	=	205.3	(80)

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West	0.9x	0.77	x	3.12	x	115.77	x	0.63	x	0.7	=	110.39	(80)
West	0.9x	0.77	x	3.12	x	115.77	x	0.63	x	0.7	=	110.39	(80)
West	0.9x	0.77	x	3.12	x	115.77	x	0.63	x	0.7	=	110.39	(80)
West	0.9x	0.77	x	4.4	x	115.77	x	0.63	x	0.7	=	155.68	(80)
West	0.9x	0.77	x	3.12	x	115.77	x	0.63	x	0.7	=	110.39	(80)
West	0.9x	0.77	x	5.94	x	115.77	x	0.63	x	0.7	=	210.16	(80)
West	0.9x	0.77	x	3.12	x	110.22	x	0.63	x	0.7	=	105.09	(80)
West	0.9x	0.77	x	3.12	x	110.22	x	0.63	x	0.7	=	105.09	(80)
West	0.9x	0.77	x	3.12	x	110.22	x	0.63	x	0.7	=	105.09	(80)
West	0.9x	0.77	x	4.4	x	110.22	x	0.63	x	0.7	=	148.21	(80)
West	0.9x	0.77	x	3.12	x	110.22	x	0.63	x	0.7	=	105.09	(80)
West	0.9x	0.77	x	5.94	x	110.22	x	0.63	x	0.7	=	200.08	(80)
West	0.9x	0.77	x	3.12	x	94.68	x	0.63	x	0.7	=	90.27	(80)
West	0.9x	0.77	x	3.12	x	94.68	x	0.63	x	0.7	=	90.27	(80)
West	0.9x	0.77	x	3.12	x	94.68	x	0.63	x	0.7	=	90.27	(80)
West	0.9x	0.77	x	4.4	x	94.68	x	0.63	x	0.7	=	127.31	(80)
West	0.9x	0.77	x	3.12	x	94.68	x	0.63	x	0.7	=	90.27	(80)
West	0.9x	0.77	x	5.94	x	94.68	x	0.63	x	0.7	=	171.87	(80)
West	0.9x	0.77	x	3.12	x	73.59	x	0.63	x	0.7	=	70.17	(80)
West	0.9x	0.77	x	3.12	x	73.59	x	0.63	x	0.7	=	70.17	(80)
West	0.9x	0.77	x	3.12	x	73.59	x	0.63	x	0.7	=	70.17	(80)
West	0.9x	0.77	x	4.4	x	73.59	x	0.63	x	0.7	=	98.96	(80)
West	0.9x	0.77	x	3.12	x	73.59	x	0.63	x	0.7	=	70.17	(80)
West	0.9x	0.77	x	5.94	x	73.59	x	0.63	x	0.7	=	133.59	(80)
West	0.9x	0.77	x	3.12	x	45.59	x	0.63	x	0.7	=	43.47	(80)
West	0.9x	0.77	x	3.12	x	45.59	x	0.63	x	0.7	=	43.47	(80)
West	0.9x	0.77	x	3.12	x	45.59	x	0.63	x	0.7	=	43.47	(80)
West	0.9x	0.77	x	4.4	x	45.59	x	0.63	x	0.7	=	61.3	(80)
West	0.9x	0.77	x	3.12	x	45.59	x	0.63	x	0.7	=	43.47	(80)
West	0.9x	0.77	x	5.94	x	45.59	x	0.63	x	0.7	=	82.76	(80)
West	0.9x	0.77	x	3.12	x	24.49	x	0.63	x	0.7	=	23.35	(80)
West	0.9x	0.77	x	3.12	x	24.49	x	0.63	x	0.7	=	23.35	(80)
West	0.9x	0.77	x	3.12	x	24.49	x	0.63	x	0.7	=	23.35	(80)
West	0.9x	0.77	x	4.4	x	24.49	x	0.63	x	0.7	=	32.93	(80)
West	0.9x	0.77	x	3.12	x	24.49	x	0.63	x	0.7	=	23.35	(80)
West	0.9x	0.77	x	5.94	x	24.49	x	0.63	x	0.7	=	44.46	(80)
West	0.9x	0.77	x	3.12	x	16.15	x	0.63	x	0.7	=	15.4	(80)
West	0.9x	0.77	x	3.12	x	16.15	x	0.63	x	0.7	=	15.4	(80)
West	0.9x	0.77	x	3.12	x	16.15	x	0.63	x	0.7	=	15.4	(80)
West	0.9x	0.77	x	4.4	x	16.15	x	0.63	x	0.7	=	21.72	(80)
West	0.9x	0.77	x	3.12	x	16.15	x	0.63	x	0.7	=	15.4	(80)

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West	0.9x	0.77	x	5.94	x	16.15	x	0.63	x	0.7	=	29.32	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	291.83	570.89	940.17	1371.18	1680.43	1720.22	1637.72	1406.78	1093.46	677.41	363.88	239.99	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	967.17	1243.84	1590.28	1983.54	2252.7	2255.25	2149.44	1925.38	1632.23	1254.17	984.38	895	(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	0.99	0.96	0.89	0.75	0.58	0.43	0.5	0.76	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.16	19.43	19.86	20.39	20.76	20.94	20.98	20.97	20.82	20.27	19.61	19.12	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.21	20.21	20.22	20.22	20.23	20.23	20.24	20.23	20.22	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.87	0.71	0.52	0.36	0.42	0.71	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.68	18.07	18.71	19.46	19.95	20.18	20.22	20.22	20.05	19.31	18.35	17.63	(90)

fLA = Living area ÷ (4) = 0.2 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.98	18.35	18.94	19.65	20.12	20.33	20.38	20.37	20.2	19.5	18.61	17.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.98	18.35	18.94	19.65	20.12	20.33	20.38	20.37	20.2	19.5	18.61	17.94	(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	0.85	0.71	0.53	0.38	0.44	0.71	0.92	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	957.86	1215.92	1498.89	1695.76	1597	1186.3	810.31	839.94	1152.18	1158.64	966.88	888.39	(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=	3111.45	3048.55	2811.98	2391.97	1866.6	1250.38	824.12	863.42	1340.36	1974.05	2567.89	3084.89	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1602.27	1231.53	976.94	501.27	200.59	0	0	0	0	606.66	1152.73	1634.19	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 7906.18 (98)

Space heating requirement in kWh/m²/year 29.83 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		7906.18	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	8301.49	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2342.28	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2459.39	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	107.61	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		608.01	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	608.01	(331)
Energy for lighting (calculated in Appendix L)		688.23	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		12057.12	(338)

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12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	2554.23	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	55.85	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	2610.08	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				2610.08	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	315.56	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	357.19	(379)
Total CO2, kg/year	sum of (376)…(382) =			3282.83	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			12.39	(384)
EI rating (section 14)				85.81	(385)

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