

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 9

Address : Flat_9

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
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	m ³ 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
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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
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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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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

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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 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
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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
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Average = Sum(40)_{1...12} / 12 =

0.9 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.82 (42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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
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(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(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
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(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
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(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
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(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
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(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
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(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
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Output from water heater (annual)_{1...12}

2125.69

(64)

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

(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
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(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
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(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
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(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
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(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(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
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(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
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(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
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(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 m ²	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)

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

DER WorkSheet: New dwelling design stage

(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 × (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 × [(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 × [(97)m – (95)m] × (41)m

(98)m=	684.53	534.5	430.83	218.35	76.43	0	0	0	0	242.04	482.14	697.9	(98)
--------	--------	-------	--------	--------	-------	---	---	---	---	--------	--------	-------	------

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

30.45	(99)
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9b. Energy requirements – Community heating scheme

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

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

0	(301)
---	-------

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

1	(302)
---	-------

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

Fraction of heat from Community heat pump

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

(302) × (303a) =	1	(304a)
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Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
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Distribution loss factor (Table 12c) for community heating system

1.05	(306)
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Space heating

Annual space heating requirement

kWh/year	
3366.72	

DER WorkSheet: New dwelling design stage

Space heat from Community heat pump	$(98) \times (304a) \times (305) \times (306) =$	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	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		2125.69	
If DHW from community scheme:			
Water heat from Community heat pump	$(64) \times (303a) \times (305) \times (306) =$	2231.97	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	57.67	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	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			250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	=	1197.24 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	29.93 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	1227.17 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			1227.17 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	=	122.86 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	=	241.55 (379)
Total CO2, kg/year	sum of (376)...(382) =			1591.57 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			14.4 (384)
EI rating (section 14)				86.29 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.41

Property Address: Stable Block - Flat 10

Address : Flat_10

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	54 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	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					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
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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
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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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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)

DER WorkSheet: New dwelling design stage

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 x (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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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 than 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	
Total = Sum(44) _{1...12} =												925.68	(44)

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

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)

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

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

$$((56)m = (55) \times (41)m$$

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

(57)m=	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)
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Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
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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)
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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)
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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	(64)
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Output from water heater (annual)_{1, 12}

1748.22

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(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)
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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)
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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)
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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)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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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)
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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)
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6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m ²		Flux Table 6a		g ₁ 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)

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)
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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)
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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)
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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)
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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)
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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)
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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)
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8. Space heating requirement

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

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

(94)m=	0.97	0.95	0.9	0.78	0.62	0.44	0.31	0.35	0.58	0.84	0.95	0.97	(94)
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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)
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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)
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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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DER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(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/m ² /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 heat pump 1 (303a)

Fraction of total space heat from Community heat pump (302) × (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

Annual space heating requirement kWh/year
1098.07

Space heat from Community heat pump (98) × (304a) × (305) × (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) × (301) × 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1748.22

If DHW from community scheme:

Water heat from Community heat pump (64) × (303a) × (305) × (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			250 (367a)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	=	620.43	(367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	15.51	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	635.94	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			635.94	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	60.01	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	132.03	(379)
Total CO2, kg/year	sum of (376)...(382) =			827.98	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			15.33	(384)
EI rating (section 14)				88.79	(385)

DRAFT

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(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	116 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	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					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
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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
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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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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

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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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.85 (42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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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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	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	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)

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	20.4	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 × (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 × [(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 × [(97)m – (95)m] × (41)m

(98)m=	382.05	267.73	195.73	87.51	28.39	0	0	0	0	86.93	238.13	394.8	(98)
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	-------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1681.26	(99)
---	---------	------

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 heat pump

1	(303a)
---	--------

Fraction of total space heat from Community heat pump

(302) × (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

Annual space heating requirement

kWh/year	
1681.26	

DER WorkSheet: New dwelling design stage

Space heat from Community heat pump	$(98) \times (304a) \times (305) \times (306) =$	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	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		2136.26	
If DHW from community scheme:			
Water heat from Community heat pump	$(64) \times (303a) \times (305) \times (306) =$	2243.08	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	40.08	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	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)

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			250 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	=	832.14 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	20.8 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	852.95 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			852.95 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	128.9 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	242.85 (379)
Total CO2, kg/year	sum of (376)...(382) =			1224.7 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			10.56 (384)
EI rating (section 14)				89.81 (385)

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 12

Address : Flat_12

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	78 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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

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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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.42 (42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
100.94	97.27	93.6	89.93	86.26	82.59	82.59	86.26	89.93	93.6	97.27	100.94

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
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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
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(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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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
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(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
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(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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
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(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
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(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
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(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 m ²	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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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)

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 T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(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, $h_m G_m$, $W = (94)m \times (84)m$

(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(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, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(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 $kWh/m^2/year$

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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) $\times$ (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

Annual space heating requirement

kWh/year

1447.15

Space heat from Community heat pump

(98) $\times$ (304a) $\times$ (305) $\times$ (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) $\times$ (301) $\times$ 100 $\div$ (308) =

0 (309)

Water heating

Annual water heating requirement

1978.34

If DHW from community scheme:

Water heat from Community heat pump

(64) $\times$ (303a) $\times$ (305) $\times$ (306) =

2077.25 (310a)

Electricity used for heat distribution

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

35.97 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) $\div$ (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		250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 746.69 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 18.67 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 765.35 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		765.35 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 86.68 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 179.45 (379)
Total CO2, kg/year	sum of (376)...(382) =		1031.48 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		13.22 (384)
EI rating (section 14)			88.76 (385)

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(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	78 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	0 (8)
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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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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

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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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.42 (42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
100.94	97.27	93.6	89.93	86.26	82.59	82.59	86.26	89.93	93.6	97.27	100.94

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)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.71

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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 × [(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.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²	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)

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

DER WorkSheet: New dwelling design stage

(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 T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, hmG_m , $W = (94)m \times (84)m$

(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(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, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(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 $kWh/m^2/year$

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 heat pump

1

 (303a)

Fraction of total space heat from Community heat pump

(302) $\times$ (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

Annual space heating requirement

kWh/year

1821.48

Space heat from Community heat pump

(98) $\times$ (304a) $\times$ (305) $\times$ (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) $\times$ (301) $\times$ 100 $\div$ (308) =

0

 (309)

Water heating

Annual water heating requirement

1978.34

If DHW from community scheme:

Water heat from Community heat pump

(64) $\times$ (303a) $\times$ (305) $\times$ (306) =

2077.25

 (310a)

Electricity used for heat distribution

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

39.9

 (313)

Cooling System Energy Efficiency Ratio

0

 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) $\div$ (314) =

0

 (315)

DER WorkSheet: New dwelling design stage

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

mechanical ventilation - balanced, extract or positive input from outside

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		250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 828.29 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 20.71 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 848.99 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		848.99 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 86.68 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 179.45 (379)
Total CO2, kg/year	sum of (376)...(382) =		1115.12 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		14.3 (384)
EI rating (section 14)			87.85 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.41

Property Address: Stable Block - Flat 14

Address : Flat_14

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	112 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	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	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 (15)
---------------------	--------

Infiltration rate	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	0.85 (20)
----------------	-----------

Infiltration rate incorporating shelter factor	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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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

DER WorkSheet: New dwelling design stage

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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.83 (42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
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(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 m ²	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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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)

DER WorkSheet: New dwelling design stage

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

(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

(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)

(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)

(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)

(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)

(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

(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

(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:

(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

(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

(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=	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

(98)m=	392.39	284.56	214.13	97.76	31.58	0	0	0	0	100.01	251.37	403.42	(98)
--------	--------	--------	--------	-------	-------	---	---	---	---	--------	--------	--------	------

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

1775.23

(98)

Space heating requirement in kWh/m²/year

15.85

(99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

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

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

0 (301)

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

1 (302)

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

Fraction of heat from Community heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) x (303a) =

1 (304a)

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

1 (305)

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

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1775.23

Space heat from Community heat pump

(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 heat pump

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

2235.18 (310a)

Electricity used for heat distribution

0.01 x [(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)

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		250 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	= 850.99 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 21.27 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 872.26 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	= 0 (375)

DER WorkSheet: New dwelling design stage

Total CO2 associated with space and water heating	(373) + (374) + (375) =		872.26	(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) =		1233.62	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =		11.01	(384)
El rating (section 14)			89.47	(385)

DRAFT

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 15

Address : Flat_15

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
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	m ³ 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					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
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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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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)

DER WorkSheet: New dwelling design stage

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 x (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
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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 than 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=	84.85	81.77	78.68	75.6	72.51	69.43	69.43	72.51	75.6	78.68	81.77	84.85
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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
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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)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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

(66)m=

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m ²		Flux Table 6a		g ₁ 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)

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	20.24	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)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

DER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(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) = $\text{Sum}(98)_{1...5,9...12} =$ 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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) x (303a) = 1 (304a)

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

1 (305)

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

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
1095.58

Space heat from Community heat pump

(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 heat pump

(64) x (303a) x (305) x (306) = 1835.63 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 29.86 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 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 CO ₂ /kWh	Emissions kg CO ₂ /year
CO ₂ 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		250 (367a)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	=	619.89	(367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	15.5	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	635.39	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			635.39	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	60.01	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	132.03	(379)
Total CO2, kg/year	sum of (376)...(382) =			827.43	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			15.32	(384)
EI rating (section 14)				88.8	(385)

DRAFT

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(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	54 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	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	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)
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If no draught lobby, enter 0.05, else enter 0	0 (13)
---	--------

Percentage of windows and doors draught stripped	0 (14)
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Window infiltration	0 (15)
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Infiltration rate	0 (16)
-------------------	--------

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)
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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	0.85 (20)
----------------	-----------

Infiltration rate incorporating shelter factor	0.13 (21)
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Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 33.03 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (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 × [1 - exp(-0.000349 × (TFA -13.9)²)] + 0.0013 × (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × 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 than 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 × (43)													

(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	
Total = Sum(44) _{1...12} =												925.68	(44)

Energy content of hot water used - calculated monthly = 4.190 × Vd,m × nm × 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) × (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) × (51) × (52) × (53) = 0 (54)

Enter (50) or (54) in (55) 0.71 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
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 (73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²	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)

DER WorkSheet: New dwelling design stage

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)
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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)
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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)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

DER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(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) = $\text{Sum}(98)_{1...5,9...12} =$ 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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) x (303a) = 1 (304a)

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

1 (305)

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

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
1019.89

Space heat from Community heat pump

(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 heat pump

(64) x (303a) x (305) x (306) = 1835.63 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 29.07 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 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)

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		250 (367a)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	=	603.39	(367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	15.08	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	618.48	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			618.48	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	52.67	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	132.03	(379)
Total CO2, kg/year	sum of (376)...(382) =			803.18	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			14.87	(384)
EI rating (section 14)				89.13	(385)

DRAFT

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(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	156.23 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	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					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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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)

DER WorkSheet: New dwelling design stage

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 x (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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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 than 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=	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)

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

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)

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

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

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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
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 (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
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 (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
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 (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
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 (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 × [(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
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 (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

(66)m=

	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
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 (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
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 (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
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 (73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²	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)

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 T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(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, $h_m G_m$, $W = (94)m \times (84)m$

(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(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, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(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 $kWh/m^2/year$

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 heat pump

1

 (303a)

Fraction of total space heat from Community heat pump

(302) $\times$ (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

Annual space heating requirement

kWh/year

2326.7

Space heat from Community heat pump

(98) $\times$ (304a) $\times$ (305) $\times$ (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) $\times$ (301) $\times$ 100 $\div$ (308) =

0

 (309)

Water heating

Annual water heating requirement

2172.54

If DHW from community scheme:

Water heat from Community heat pump

(64) $\times$ (303a) $\times$ (305) $\times$ (306) =

2281.17

 (310a)

Electricity used for heat distribution

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

47.24

 (313)

Cooling System Energy Efficiency Ratio

0

 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$

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		250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 980.75 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 24.52 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1005.26 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1005.26 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 173.61 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 315.23 (379)
Total CO2, kg/year	sum of (376)...(382) =		1494.11 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		9.56 (384)
EI rating (section 14)			90.05 (385)

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 18

Address : Flat_18

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	88 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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

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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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.6 (42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

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

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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

(66)m=

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²	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)

DER WorkSheet: New dwelling design stage

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)

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

DER WorkSheet: New dwelling design stage

(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 T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(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, $h_m G_m$, $W = (94)m \times (84)m$

(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(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, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(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 ($kWh/year$) = $Sum(98)_{1...12} =$

1581.56

 (98)

Space heating requirement in $kWh/m^2/year$

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 heat pump

1

 (303a)

Fraction of total space heat from Community heat pump

(302) $\times$ (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

Annual space heating requirement

kWh/year

1581.56

Space heat from Community heat pump

(98) $\times$ (304a) $\times$ (305) $\times$ (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) $\times$ (301) $\times$ 100 $\div$ (308) =

0

 (309)

Water heating

Annual water heating requirement

2043.18

If DHW from community scheme:

Water heat from Community heat pump

(64) $\times$ (303a) $\times$ (305) $\times$ (306) =

2145.34

 (310a)

Electricity used for heat distribution

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

38.06

 (313)

Cooling System Energy Efficiency Ratio

0

 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$

0

 (315)

DER WorkSheet: New dwelling design stage

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

mechanical ventilation - balanced, extract or positive input from outside

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		250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 790.12 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 19.75 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 809.87 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		809.87 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 97.79 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 200.52 (379)
Total CO2, kg/year	sum of (376)...(382) =		1108.18 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		12.59 (384)
EI rating (section 14)			88.83 (385)

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 19

Address : Flat_19

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	54 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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)

DER WorkSheet: New dwelling design stage

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 x (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
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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 than 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=	84.85	81.77	78.68	75.6	72.51	69.43	69.43	72.51	75.6	78.68	81.77	84.85
--------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	-------

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)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
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 (73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²	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)
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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)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

DER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(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) = $\text{Sum}(98)_{1...5,9...12} =$ 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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) x (303a) = 1 (304a)

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

1 (305)

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

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
1095.58

Space heat from Community heat pump

(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 heat pump

(64) x (303a) x (305) x (306) = 1835.63 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 29.86 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 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 CO ₂ /kWh	Emissions kg CO ₂ /year
CO ₂ 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		250 (367a)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	=	619.89	(367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	15.5	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	635.39	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			635.39	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	60.01	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	132.03	(379)
Total CO2, kg/year	sum of (376)...(382) =			827.43	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			15.32	(384)
EI rating (section 14)				88.8	(385)

DRAFT

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 20

Address : Flat_20

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	54.01 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	0 (8)
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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
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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
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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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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)

DER WorkSheet: New dwelling design stage

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 x (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
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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 than 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=	84.86	81.78	78.69	75.6	72.52	69.43	69.43	72.52	75.6	78.69	81.78	84.86
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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
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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
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(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)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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
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 (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
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 (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
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 (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
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 (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
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 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 × [(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
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
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 (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
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 (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
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 (73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²	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)
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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)
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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)
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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)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

DER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(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/m ² /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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) x (303a) = 1 (304a)

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

1 (305)

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

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
1474.4

Space heat from Community heat pump

(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 heat pump

(64) x (303a) x (305) x (306) = 1835.75 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] = 33.84$ (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		250 (367a)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	=	702.49	(367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	17.56	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	720.05	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			720.05	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	60.02	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	133.06	(379)
Total CO2, kg/year	sum of (376)...(382) =			913.13	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			16.91	(384)
El rating (section 14)				87.64	(385)

DRAFT

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(m ²)	Av. Height(m)	Volume(m ³)
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	m ³ 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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
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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
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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
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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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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

DER WorkSheet: New dwelling design stage

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 x (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=	94.83	94.51	94.18	92.54	92.21	90.58	90.58	90.25	91.23	92.21	92.87	93.52
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Average = Sum(39)_{1...12} / 12 =

92.46 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

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

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

0.8 (40)

Number of days in month (Table 1a)

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

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.84 (42)

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 than 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)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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

(66)m=

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²		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	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)

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	5.61	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)

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

DER WorkSheet: New dwelling design stage

(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	20.26	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 × (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 × [(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 × [(97)m – (95)m] × (41)m

(98)m=	531.78	397.97	323.57	181.99	84.28	0	0	0	0	172.83	360.09	546.03	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2598.54	(98)
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Space heating requirement in kWh/m²/year

22.55	(99)
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9b. Energy requirements – Community heating scheme

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

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

0	(301)
---	-------

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

1	(302)
---	-------

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

Fraction of heat from Community heat pump

1	(303a)
---	--------

Fraction of total space heat from Community heat pump

(302) × (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

Annual space heating requirement

kWh/year	
2598.54	

DER WorkSheet: New dwelling design stage

Space heat from Community heat pump	$(98) \times (304a) \times (305) \times (306) =$	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	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		2134.92	
If DHW from community scheme:			
Water heat from Community heat pump	$(64) \times (303a) \times (305) \times (306) =$	2241.66	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	49.7	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	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		250	(367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	=	1031.8 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	25.79 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	1057.59 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			1057.59 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	=	128.05 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	=	238.19 (379)
Total CO2, kg/year	sum of (376)...(382) =			1423.83 (383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			12.36 (384)
EI rating (section 14)				88.09 (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 22

Address : Flat_22

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	78.11 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	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					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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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

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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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.43 (42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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
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(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
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(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
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(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
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(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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
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(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
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(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
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(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(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
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(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
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(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 m ²	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)

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)

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	0.97	0.95	0.91	0.84	0.71	0.55	0.41	0.44	0.65	0.87	0.95	0.98	

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 T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(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, $h_m G_m$, $W = (94)m \times (84)m$

(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(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, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(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 $kWh/m^2/year$

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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) x (303a) =

1 (304a)

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

1 (305)

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

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1952.13

Space heat from Community heat pump

(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 heat pump

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

2078.12 (310a)

Electricity used for heat distribution

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

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		250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 856.94 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 21.42 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 878.37 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		878.37 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 86.8 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 182.49 (379)
Total CO2, kg/year	sum of (376)...(382) =		1147.66 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		14.69 (384)
EI rating (section 14)			87.51 (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(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	88.4 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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

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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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.6

(42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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

(66)m=

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²		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)

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)

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

DER WorkSheet: New dwelling design stage

(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 T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(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, $h_m G_m$, $W = (94)m \times (84)m$

(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(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, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(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 $kWh/m^2/year$

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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) $\times$ (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

Annual space heating requirement

kWh/year

2390.23

Space heat from Community heat pump

(98) $\times$ (304a) $\times$ (305) $\times$ (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) $\times$ (301) $\times$ 100 $\div$ (308) =

0 (309)

Water heating

Annual water heating requirement

2045.36

If DHW from community scheme:

Water heat from Community heat pump

(64) $\times$ (303a) $\times$ (305) $\times$ (306) =

2147.63 (310a)

Electricity used for heat distribution

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

46.57 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) $\div$ (314) =

0 (315)

DER WorkSheet: New dwelling design stage

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

mechanical ventilation - balanced, extract or positive input from outside

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		250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 966.87 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 24.17 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 991.04 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		991.04 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 98.23 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 205.07 (379)
Total CO2, kg/year	sum of (376)...(382) =		1294.34 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		14.64 (384)
EI rating (section 14)			87 (385)

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(m ²)	Av. Height(m)	Volume(m ³)
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	m ³ 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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
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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)
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Additional infiltration	[(9)-1]x0.1 =	0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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

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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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.84 (42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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 m ²	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)

DER WorkSheet: New dwelling design stage

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

(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

(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)

(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)

(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)

(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)

(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

(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

(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:

(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

(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

(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=	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

(98)m=	529.74	407.76	338.86	192.84	89.03	0	0	0	0	184.84	364.62	540.9	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	-------	------

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

2648.58

Space heating requirement in kWh/m²/year

22.99

(99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

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

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

0 (301)

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

1 (302)

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

Fraction of heat from Community heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) x (303a) =

1 (304a)

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

1 (305)

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

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

2648.58

Space heat from Community heat pump

(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 heat pump

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

2241.66 (310a)

Electricity used for heat distribution

0.01 x [(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)

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		250 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	= 1042.71 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 26.07 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 1068.77 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	= 0 (375)

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Total CO2 associated with space and water heating	(373) + (374) + (375) =		1068.77	(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) =		1440.29	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =		12.5	(384)
El rating (section 14)			87.95	(385)

DRAFT

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 25

Address : Flat_25

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
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	m ³ 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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
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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
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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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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)

DER WorkSheet: New dwelling design stage

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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
84.84	81.75	78.67	75.58	72.5	69.41	69.41	72.5	75.58	78.67	81.75	84.84

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
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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
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(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

$$((56)m = (55) \times (41)m$$

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

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

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

(62)m=	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)
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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)
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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 × [(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)
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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)
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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)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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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)
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6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m ²		Flux Table 6a		g ₁ 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)

DER WorkSheet: New dwelling design stage

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)
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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)
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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)
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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)
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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)
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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)
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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)
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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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DER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(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/m ² /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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) x (303a) = 1 (304a)

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

1 (305)

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

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1473.46

Space heat from Community heat pump

(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 heat pump

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

1835.4 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

33.83 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$

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		250 (367a)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	=	702.21	(367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	17.56	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	719.77	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			719.77	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	59.98	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	132.98	(379)
Total CO2, kg/year	sum of (376)...(382) =			912.74	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			16.91	(384)
EI rating (section 14)				87.64	(385)

DRAFT

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 26

Address : Flat_26

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	54.01 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	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
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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
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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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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)

DER WorkSheet: New dwelling design stage

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 x (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 than 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=	84.86	81.78	78.69	75.6	72.52	69.43	69.43	72.52	75.6	78.69	81.78	84.86
--------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	-------

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)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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

(66)m=

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²	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)

DER WorkSheet: New dwelling design stage

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)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

DER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(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) = $\text{Sum}(98)_{1...5,9...12} =$ 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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) x (303a) =

1 (304a)

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

1 (305)

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

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1474.4

Space heat from Community heat pump

(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 heat pump

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

1835.75 (310a)

Electricity used for heat distribution

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

33.84 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$

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

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

250 (367a)

Energy
kWh/year

Emission factor
kg CO2/kWh

Emissions
kg CO2/year

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	=	702.49	(367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	17.56	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	720.05	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			720.05	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	60.02	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	133.06	(379)
Total CO2, kg/year	sum of (376)...(382) =			913.13	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			16.91	(384)
EI rating (section 14)				87.64	(385)

DRAFT

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(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	78.11 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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

DER WorkSheet: New dwelling design stage

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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.43 (42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
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(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 m ²		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)

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)

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	0.98	0.97	0.94	0.87	0.75	0.58	0.43	0.49	0.72	0.91	0.97	0.98	

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 T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(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, $h_m G_m$, $W = (94)m \times (84)m$

(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(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, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(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 $kWh/m^2/year$

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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) x (303a) =

1 (304a)

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

1 (305)

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

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

2190.51

Space heat from Community heat pump

(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 heat pump

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

2078.12 (310a)

Electricity used for heat distribution

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

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		250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 908.9 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 22.72 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 931.63 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		931.63 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 86.8 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 182.49 (379)
Total CO2, kg/year	sum of (376)...(382) =		1200.92 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		15.37 (384)
EI rating (section 14)			86.93 (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 28

Address : Flat_28

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	78.4 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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

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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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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)

2.43 (42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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

(66)m=

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²	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)

DER WorkSheet: New dwelling design stage

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)

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)

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	0.98	0.96	0.92	0.85	0.73	0.57	0.42	0.46	0.67	0.88	0.96	0.98	

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

DER WorkSheet: New dwelling design stage

(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 T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(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, $h_m G_m$, $W = (94)m \times (84)m$

(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(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, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(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 $kWh/m^2/year$

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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) $\times$ (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

Annual space heating requirement

kWh/year

2102.81

Space heat from Community heat pump

(98) $\times$ (304a) $\times$ (305) $\times$ (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) $\times$ (301) $\times$ 100 $\div$ (308) =

0 (309)

Water heating

Annual water heating requirement

1981.32

If DHW from community scheme:

Water heat from Community heat pump

(64) $\times$ (303a) $\times$ (305) $\times$ (306) =

2080.39 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

42.88 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) $\div$ (314) =

0 (315)

DER WorkSheet: New dwelling design stage

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

mechanical ventilation - balanced, extract or positive input from outside

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		250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 890.26 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 22.26 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 912.52 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		912.52 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 87.12 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 183.14 (379)
Total CO2, kg/year	sum of (376)...(382) =		1182.78 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		15.09 (384)
EI rating (section 14)			87.16 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.41

Property Address: Stable Block - Flat 29

Address : Flat_29

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	53.98 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	0 (8)
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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)

DER WorkSheet: New dwelling design stage

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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
84.84	81.75	78.67	75.58	72.5	69.41	69.41	72.5	75.58	78.67	81.75	84.84

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)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
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 (73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²	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)

DER WorkSheet: New dwelling design stage

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)
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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)
--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	-------	--------	--------	------

DER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(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/m ² /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 heat pump 1 (303a)

Fraction of total space heat from Community heat pump (302) × (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

Annual space heating requirement kWh/year
1473.46

Space heat from Community heat pump (98) × (304a) × (305) × (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) × (301) × 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1748

If DHW from community scheme:

Water heat from Community heat pump (64) × (303a) × (305) × (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			250 (367a)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	=	702.21	(367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	17.56	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	719.77	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			719.77	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	59.98	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	132.98	(379)
Total CO2, kg/year	sum of (376)...(382) =			912.74	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			16.91	(384)
El rating (section 14)				87.64	(385)

DRAFT

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(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	146.84 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	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					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
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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	$\times 1/[1/(1.4) + 0.04] =$	1.56		(27)
Windows Type 2			4.37	$\times 1/[1/(1.4) + 0.04] =$	5.79		(27)
Windows Type 3			1.18	$\times 1/[1/(1.4) + 0.04] =$	1.56		(27)
Windows Type 4			1.43	$\times 1/[1/(1.4) + 0.04] =$	1.9		(27)
Windows Type 5			1.43	$\times 1/[1/(1.4) + 0.04] =$	1.9		(27)
Windows Type 6			4.2	$\times 1/[1/(1.4) + 0.04] =$	5.57		(27)
Windows Type 7			3.52	$\times 1/[1/(1.4) + 0.04] =$	4.67		(27)
Windows Type 8			1.61	$\times 1/[1/(1.4) + 0.04] =$	2.13		(27)
Windows Type 9			3.84	$\times 1/[1/(1.4) + 0.04] =$	5.09		(27)
Windows Type 10			2.9	$\times 1/[1/(1.4) + 0.04] =$	3.84		(27)
Windows Type 11			2.18	$\times 1/[1/(1.4) + 0.04] =$	2.89		(27)
Windows Type 12			4.2	$\times 1/[1/(1.4) + 0.04] =$	5.57		(27)
Windows Type 13			4.2	$\times 1/[1/(1.4) + 0.04] =$	5.57		(27)
Windows Type 14			3.91	$\times 1/[1/(1.4) + 0.04] =$	5.18		(27)
Windows Type 15			2.9	$\times 1/[1/(1.4) + 0.04] =$	3.84		(27)
Windows Type 16			3.52	$\times 1/[1/(1.4) + 0.04] =$	4.67		(27)
Windows Type 17			4.2	$\times 1/[1/(1.4) + 0.04] =$	5.57		(27)
Windows Type 18			4.74	$\times 1/[1/(1.4) + 0.04] =$	6.28		(27)
Floor			146.84	$\times 0.12 =$	17.6208	110	16152.4 (28)

DER WorkSheet: New dwelling design stage

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, m ²			489.86							(31)
Internal wall **			150					9	1350	(32c)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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 x (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

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

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

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 than 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=	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)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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 120 (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):

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)

Water storage loss calculated for each month

((56)m = (55) x (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 x (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 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m= 214.67 189.05 198.17 177.12 173.19 154.21 147.59 162.66 162.6 183.69 194.89 209.33 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

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

Output from water heater

(64)m= 214.67 189.05 198.17 177.12 173.19 154.21 147.59 162.66 162.6 183.69 194.89 209.33

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

2167.16 (64)

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

(65)m= 92.6 82.03 87.11 79.43 78.81 71.81 70.3 75.31 74.6 82.3 85.34 90.82 (65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	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
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 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (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
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 (71)

Water heating gains (Table 5)

(72)m=

124.46	122.07	117.09	110.32	105.93	99.74	94.48	101.22	103.61	110.62	118.53	122.08
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 (72)

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

(73)m=

536.73	534.46	516.51	487.13	456.55	427.62	409.16	415.77	431.14	460.76	494.85	521.14
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 (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 m ²		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)

DER WorkSheet: New dwelling design stage

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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Southwest0.9x	0.77	x	3.91	x	106.25	0.63	x	0.7	=	126.97	(79)
Southwest0.9x	0.77	x	4.2	x	106.25	0.63	x	0.7	=	136.38	(79)
Southwest0.9x	0.77	x	1.61	x	119.01	0.63	x	0.7	=	58.56	(79)
Southwest0.9x	0.77	x	2.9	x	119.01	0.63	x	0.7	=	105.48	(79)
Southwest0.9x	0.77	x	2.18	x	119.01	0.63	x	0.7	=	79.29	(79)
Southwest0.9x	0.77	x	4.2	x	119.01	0.63	x	0.7	=	152.76	(79)
Southwest0.9x	0.77	x	4.2	x	119.01	0.63	x	0.7	=	152.76	(79)
Southwest0.9x	0.77	x	3.91	x	119.01	0.63	x	0.7	=	142.21	(79)
Southwest0.9x	0.77	x	4.2	x	119.01	0.63	x	0.7	=	152.76	(79)
Southwest0.9x	0.77	x	1.61	x	118.15	0.63	x	0.7	=	58.13	(79)
Southwest0.9x	0.77	x	2.9	x	118.15	0.63	x	0.7	=	104.71	(79)
Southwest0.9x	0.77	x	2.18	x	118.15	0.63	x	0.7	=	78.72	(79)
Southwest0.9x	0.77	x	4.2	x	118.15	0.63	x	0.7	=	151.65	(79)
Southwest0.9x	0.77	x	4.2	x	118.15	0.63	x	0.7	=	151.65	(79)
Southwest0.9x	0.77	x	3.91	x	118.15	0.63	x	0.7	=	141.18	(79)
Southwest0.9x	0.77	x	4.2	x	118.15	0.63	x	0.7	=	151.65	(79)
Southwest0.9x	0.77	x	1.61	x	113.91	0.63	x	0.7	=	56.05	(79)
Southwest0.9x	0.77	x	2.9	x	113.91	0.63	x	0.7	=	100.96	(79)
Southwest0.9x	0.77	x	2.18	x	113.91	0.63	x	0.7	=	75.89	(79)
Southwest0.9x	0.77	x	4.2	x	113.91	0.63	x	0.7	=	146.21	(79)
Southwest0.9x	0.77	x	4.2	x	113.91	0.63	x	0.7	=	146.21	(79)
Southwest0.9x	0.77	x	3.91	x	113.91	0.63	x	0.7	=	136.12	(79)
Southwest0.9x	0.77	x	4.2	x	113.91	0.63	x	0.7	=	146.21	(79)
Southwest0.9x	0.77	x	1.61	x	104.39	0.63	x	0.7	=	51.36	(79)
Southwest0.9x	0.77	x	2.9	x	104.39	0.63	x	0.7	=	92.52	(79)
Southwest0.9x	0.77	x	2.18	x	104.39	0.63	x	0.7	=	69.55	(79)
Southwest0.9x	0.77	x	4.2	x	104.39	0.63	x	0.7	=	133.99	(79)
Southwest0.9x	0.77	x	4.2	x	104.39	0.63	x	0.7	=	133.99	(79)
Southwest0.9x	0.77	x	3.91	x	104.39	0.63	x	0.7	=	124.74	(79)
Southwest0.9x	0.77	x	4.2	x	104.39	0.63	x	0.7	=	133.99	(79)
Southwest0.9x	0.77	x	1.61	x	92.85	0.63	x	0.7	=	45.69	(79)
Southwest0.9x	0.77	x	2.9	x	92.85	0.63	x	0.7	=	82.29	(79)
Southwest0.9x	0.77	x	2.18	x	92.85	0.63	x	0.7	=	61.86	(79)
Southwest0.9x	0.77	x	4.2	x	92.85	0.63	x	0.7	=	119.18	(79)
Southwest0.9x	0.77	x	4.2	x	92.85	0.63	x	0.7	=	119.18	(79)
Southwest0.9x	0.77	x	3.91	x	92.85	0.63	x	0.7	=	110.95	(79)
Southwest0.9x	0.77	x	4.2	x	92.85	0.63	x	0.7	=	119.18	(79)
Southwest0.9x	0.77	x	1.61	x	69.27	0.63	x	0.7	=	34.08	(79)
Southwest0.9x	0.77	x	2.9	x	69.27	0.63	x	0.7	=	61.39	(79)
Southwest0.9x	0.77	x	2.18	x	69.27	0.63	x	0.7	=	46.15	(79)
Southwest0.9x	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	0.63	x	0.7	=	4.93	(81)
Northwest	0.9x	0.77	x	1.43	x	11.28	0.63	x	0.7	=	4.93	(81)
Northwest	0.9x	0.77	x	4.2	x	11.28	0.63	x	0.7	=	14.48	(81)
Northwest	0.9x	0.77	x	4.74	x	11.28	0.63	x	0.7	=	16.34	(81)
Northwest	0.9x	0.77	x	1.43	x	22.97	0.63	x	0.7	=	10.04	(81)
Northwest	0.9x	0.77	x	1.43	x	22.97	0.63	x	0.7	=	10.04	(81)
Northwest	0.9x	0.77	x	4.2	x	22.97	0.63	x	0.7	=	29.48	(81)
Northwest	0.9x	0.77	x	4.74	x	22.97	0.63	x	0.7	=	33.27	(81)
Northwest	0.9x	0.77	x	1.43	x	41.38	0.63	x	0.7	=	18.08	(81)
Northwest	0.9x	0.77	x	1.43	x	41.38	0.63	x	0.7	=	18.08	(81)
Northwest	0.9x	0.77	x	4.2	x	41.38	0.63	x	0.7	=	53.11	(81)
Northwest	0.9x	0.77	x	4.74	x	41.38	0.63	x	0.7	=	59.94	(81)
Northwest	0.9x	0.77	x	1.43	x	67.96	0.63	x	0.7	=	29.7	(81)
Northwest	0.9x	0.77	x	1.43	x	67.96	0.63	x	0.7	=	29.7	(81)
Northwest	0.9x	0.77	x	4.2	x	67.96	0.63	x	0.7	=	87.23	(81)
Northwest	0.9x	0.77	x	4.74	x	67.96	0.63	x	0.7	=	98.44	(81)
Northwest	0.9x	0.77	x	1.43	x	91.35	0.63	x	0.7	=	39.92	(81)
Northwest	0.9x	0.77	x	1.43	x	91.35	0.63	x	0.7	=	39.92	(81)
Northwest	0.9x	0.77	x	4.2	x	91.35	0.63	x	0.7	=	117.25	(81)
Northwest	0.9x	0.77	x	4.74	x	91.35	0.63	x	0.7	=	132.32	(81)
Northwest	0.9x	0.77	x	1.43	x	97.38	0.63	x	0.7	=	42.56	(81)
Northwest	0.9x	0.77	x	1.43	x	97.38	0.63	x	0.7	=	42.56	(81)
Northwest	0.9x	0.77	x	4.2	x	97.38	0.63	x	0.7	=	125	(81)
Northwest	0.9x	0.77	x	4.74	x	97.38	0.63	x	0.7	=	141.07	(81)

DER WorkSheet: New dwelling design stage

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)

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=

965.7	1293.83	1631.69	1996.58	2263.81	2273.08	2167.04	1943.64	1681.63	1320.56	1013.88	884.87
-------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	--------

 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.98	0.94	0.86	0.71	0.54	0.41	0.46	0.71	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	19.38	19.84	20.38	20.75	20.93	20.98	20.97	20.82	20.28	19.55	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)

DER WorkSheet: New dwelling design stage

(90)m=	17.16	17.64	18.31	19.05	19.51	19.72	19.76	19.75	19.62	18.94	17.91	17.09	(90)
$fLA = \text{Living area} \div (4) =$												0.39	(91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	17.91	18.33	18.91	19.57	20	20.2	20.24	20.23	20.09	19.47	18.56	17.84	(92)
--------	-------	-------	-------	-------	----	------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	17.91	18.33	18.91	19.57	20	20.2	20.24	20.23	20.09	19.47	18.56	17.84	(93)
--------	-------	-------	-------	-------	----	------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(94)m=	0.98	0.96	0.91	0.81	0.66	0.48	0.34	0.39	0.65	0.88	0.97	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	949.77	1243.42	1491.49	1626.49	1497.06	1093.68	735.54	764.97	1085.52	1166.7	982.28	873.65	(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, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	2900.08	2854.27	2631.54	2231.53	1730.76	1150.21	747.99	785.57	1238.6	1848.93	2401.99	2876.21	(97)
--------	---------	---------	---------	---------	---------	---------	--------	--------	--------	---------	---------	---------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	1451.04	1082.49	848.2	435.62	173.87	0	0	0	0	507.58	1022.2	1489.91	(98)
--------	---------	---------	-------	--------	--------	---	---	---	---	--------	--------	---------	------

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

7010.9	(99)
--------	------

Space heating requirement in $kWh/m^2/year$

47.75	(99)
-------	------

9b. Energy requirements – Community heating scheme

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

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

0	(301)
---	-------

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

1	(302)
---	-------

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

Fraction of heat from Community heat pump

1	(303a)
---	--------

Fraction of total space heat from Community heat pump

(302) x (303a) =

1	(304a)
---	--------

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

1	(305)
---	-------

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

1.05	(306)
------	-------

Space heating

Annual space heating requirement

kWh/year

7010.9

Space heat from Community heat pump

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

7361.45	(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

2167.16

If DHW from community scheme:

Water heat from Community heat pump

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

2275.52	(310a)
---------	--------

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

96.37	(313)
-------	-------

DER WorkSheet: New dwelling design stage

Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	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) =		10638.22	(338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 2000.64 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 50.02 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 2050.65 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		2050.65 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 260.57 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 259.08 (379)
Total CO2, kg/year	sum of (376)...(382) =		2570.3 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		17.5 (384)
EI rating (section 14)			82.05 (385)

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(m ²)		Av. Height(m)		Volume(m ³)
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		m ³ 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)		
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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.16	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)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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 $1/[(1/U\text{-value})+0.04]$ 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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

107.5

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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=

118.25	113.95	109.65	105.35	101.05	96.75	96.75	101.05	105.35	109.65	113.95	118.25
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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
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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
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(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)

DER WorkSheet: New dwelling design stage

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)												
Water storage loss calculated for each month	((56)m = (55) x (41)m														
(56)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>22.13</td><td>19.99</td><td>22.13</td><td>21.42</td><td>22.13</td><td>21.42</td><td>22.13</td><td>22.13</td><td>21.42</td><td>22.13</td><td>21.42</td><td>22.13</td> </tr> </table>	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)
22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13				
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=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>22.13</td><td>19.99</td><td>22.13</td><td>21.42</td><td>22.13</td><td>21.42</td><td>22.13</td><td>22.13</td><td>21.42</td><td>22.13</td><td>21.42</td><td>22.13</td> </tr> </table>	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)
22.13	19.99	22.13	21.42	22.13	21.42	22.13	22.13	21.42	22.13	21.42	22.13				
Primary circuit loss (annual) from Table 3		0	(58)												
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m															
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)															
(59)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>23.26</td><td>21.01</td><td>23.26</td><td>22.51</td><td>23.26</td><td>22.51</td><td>23.26</td><td>23.26</td><td>22.51</td><td>23.26</td><td>22.51</td><td>23.26</td> </tr> </table>	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)
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26				
Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m															
(61)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(61)
0	0	0	0	0	0	0	0	0	0	0	0				
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m															
(62)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>220.76</td><td>194.38</td><td>203.67</td><td>181.92</td><td>177.8</td><td>158.18</td><td>151.27</td><td>166.88</td><td>166.87</td><td>188.67</td><td>200.32</td><td>215.23</td> </tr> </table>	220.76	194.38	203.67	181.92	177.8	158.18	151.27	166.88	166.87	188.67	200.32	215.23		(62)
220.76	194.38	203.67	181.92	177.8	158.18	151.27	166.88	166.87	188.67	200.32	215.23				
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=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(63)
0	0	0	0	0	0	0	0	0	0	0	0				
Output from water heater															
(64)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>220.76</td><td>194.38</td><td>203.67</td><td>181.92</td><td>177.8</td><td>158.18</td><td>151.27</td><td>166.88</td><td>166.87</td><td>188.67</td><td>200.32</td><td>215.23</td> </tr> </table>	220.76	194.38	203.67	181.92	177.8	158.18	151.27	166.88	166.87	188.67	200.32	215.23		
220.76	194.38	203.67	181.92	177.8	158.18	151.27	166.88	166.87	188.67	200.32	215.23				
	Output from water heater (annual) ^{1...12}										2225.94	(64)			
Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]															
(65)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>94.63</td><td>83.8</td><td>88.94</td><td>81.03</td><td>80.34</td><td>73.13</td><td>71.52</td><td>76.71</td><td>76.02</td><td>83.96</td><td>87.15</td><td>92.79</td> </tr> </table>	94.63	83.8	88.94	81.03	80.34	73.13	71.52	76.71	76.02	83.96	87.15	92.79		(65)
94.63	83.8	88.94	81.03	80.34	73.13	71.52	76.71	76.02	83.96	87.15	92.79				
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
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
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
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
Pumps and fans gains (Table 5a)												
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0
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

DER WorkSheet: New dwelling design stage

Water heating gains (Table 5)

(72)m=

127.19	124.7	119.55	112.54	107.98	101.57	96.13	103.11	105.59	112.84	121.04	124.71
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 (72)

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

(73)m=

664.72	662.33	639.48	601.74	561.64	524.4	501.1	507.98	528.15	566.14	609.88	644.39
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 (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 m ²		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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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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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	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)

DER WorkSheet: New dwelling design stage

West $0.9 \times \boxed{0.77} \times \boxed{5.94} \times \boxed{16.15} \times \boxed{0.63} \times \boxed{0.7} = \boxed{29.32}$ (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=

956.55	1233.22	1579.65	1972.92	2242.07	2244.62	2138.82	1914.76	1621.6	1243.54	973.76	884.37
--------	---------	---------	---------	---------	---------	---------	---------	--------	---------	--------	--------

 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.99	0.96	0.89	0.75	0.58	0.44	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=

19.15	19.42	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	0.99	0.96	0.87	0.72	0.52	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=

17.67	18.06	18.7	19.46	19.95	20.17	20.22	20.22	20.04	19.3	18.34	17.62
-------	-------	------	-------	-------	-------	-------	-------	-------	------	-------	-------

 (90)

fLA = Living area ÷ (4) =

0.2

 (91)

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

(92)m=

17.97	18.34	18.93	19.65	20.11	20.33	20.38	20.37	20.2	19.49	18.6	17.93
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------

 (92)

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

(93)m=

17.97	18.34	18.93	19.65	20.11	20.33	20.38	20.37	20.2	19.49	18.6	17.93
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=

0.99	0.98	0.94	0.86	0.71	0.53	0.38	0.44	0.71	0.93	0.98	0.99
------	------	------	------	------	------	------	------	------	------	------	------

 (94)

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

(95)m=

947.64	1206.19	1490.37	1689.7	1593.88	1185.3	810.05	839.47	1149.12	1150.71	956.98	878.09
--------	---------	---------	--------	---------	--------	--------	--------	---------	---------	--------	--------

 (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=

3109.36	3046.53	2810.19	2390.73	1866.01	1250.21	824.08	863.34	1339.78	1972.41	2565.87	3082.8
---------	---------	---------	---------	---------	---------	--------	--------	---------	---------	---------	--------

 (97)

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

(98)m=

1608.31	1236.71	981.95	504.74	202.47	0	0	0	0	611.34	1158.4	1640.31
---------	---------	--------	--------	--------	---	---	---	---	--------	--------	---------

 (98)

Total per year (kWh/year) = Sum(98)m...5,9...12 =

7944.23

 (98)

Space heating requirement in kWh/m²/year

29.98

 (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)
<i>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.</i>			
Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		7944.23	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	8341.44	(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		2225.94	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2337.24	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	106.79	(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) =		11974.92	(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		250 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	= 2216.89 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 55.42 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 2272.32 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		2272.32 (376)

DER WorkSheet: New dwelling design stage

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) =			2945.06	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			11.11	(384)
El rating (section 14)				87.27	(385)

DRAFT

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 1

Address : Flat_1

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	110.56 (1a) ×	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	m ³ per hour
Number of chimneys	0	0	0	0 × 40 =	0 (6a)
Number of open flues	0	0	0	0 × 20 =	0 (6b)
Number of intermittent fans				0 × 10 =	0 (7a)
Number of passive vents				0 × 10 =	0 (7b)
Number of flueless gas fires				0 × 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]×0.1 = 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 × (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 × (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) × (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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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)
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

DER WorkSheet: New dwelling design stage

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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.82

(42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

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

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²	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	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	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	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	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	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	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	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	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	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	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	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)
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	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)

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	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	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	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	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	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	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)
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	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	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	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	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	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= 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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

DER WorkSheet: New dwelling design stage

(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	19.21	19.54	19.98	20.28	20.41	20.43	20.42	20.35	19.94	19.41	18.99	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.02	19.21	19.54	19.98	20.28	20.41	20.43	20.42	20.35	19.94	19.41	18.99	(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	0.6	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	651.38	735.54	795.53	745.45	549.06	370.23	386.72	555.65	598.43	555.44	543.87	(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=	1491.86	1446.04	1313.99	1098.34	847.93	564.93	372.15	390.29	611.76	923.24	1224.41	1481.15	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	683.95	534.01	430.37	218.02	76.25	0	0	0	0	241.66	481.65	697.33	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	3363.25	(99)
---	---------	------

Space heating requirement in kWh/m²/year

30.42	(99)
-------	------

9b. Energy requirements – Community heating scheme

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

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

0	(301)
---	-------

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

1	(302)
---	-------

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

Fraction of heat from Community heat pump

1	(303a)
---	--------

Fraction of total space heat from Community heat pump

(302) x (303a) =	1	(304a)
------------------	---	--------

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

1	(305)
---	-------

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

1.05	(306)
------	-------

Space heating

Annual space heating requirement

kWh/year	
3363.25	

DER WorkSheet: New dwelling design stage

Space heat from Community heat pump	$(98) \times (304a) \times (305) \times (306) =$	3531.41	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		2125.69	
If DHW from community scheme:			
Water heat from Community heat pump	$(64) \times (303a) \times (305) \times (306) =$	2231.97	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	57.63	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	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) =		6465.51	(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			250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	=	1196.48 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	29.91 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	1226.39 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			1226.39 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	=	122.86 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	=	241.55 (379)
Total CO2, kg/year	sum of (376)...(382) =			1590.79 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			14.39 (384)
EI rating (section 14)				86.3 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.41

Property Address: Stable Block - Flat 2

Address : Flat_2

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	115.23 (1a) ×	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	m ³ per hour
Number of chimneys	0	0	0	0 × 40 =	0 (6a)
Number of open flues	0	0	0	0 × 20 =	0 (6b)
Number of intermittent fans				0 × 10 =	0 (7a)
Number of passive vents				0 × 10 =	0 (7b)
Number of flueless gas fires				0 × 40 =	0 (7c)

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]×0.1 = 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 × (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 × (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) × (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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	1.4	2.646		
Windows Type 1			1.76	$\times 1/[1/(1.4) + 0.04]$	2.33		
Windows Type 2			1.76	$\times 1/[1/(1.4) + 0.04]$	2.33		
Windows Type 3			1.76	$\times 1/[1/(1.4) + 0.04]$	2.33		
Windows Type 4			1.76	$\times 1/[1/(1.4) + 0.04]$	2.33		
Windows Type 5			1.76	$\times 1/[1/(1.4) + 0.04]$	2.33		
Windows Type 6			2.73	$\times 1/[1/(1.4) + 0.04]$	3.62		
Floor			115.23	0.12	13.8276	110	12675.3
Walls Type1	72.06	11.53	60.53	0.18	10.9	70	4237.1
Walls Type2	5.1	1.89	3.21	0.23	0.75	70	224.7
Total area of elements, m²			192.39				
Party wall			52.11	0	0	45	2344.95
Party ceiling			115			30	3450
Internal wall **			100			9	900

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 43.41 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 23832.05 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 206.82 (35)

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

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can be used instead of a detailed calculation.

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

16.35 (36)

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

Total fabric heat loss

(33) + (36) =

59.76 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

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

88.51	88.18	87.86	86.22	85.89	84.26	84.26	83.93	84.91	85.89	86.55	87.2
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Average = Sum(39)_{1...12} /12=

86.14 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.77	0.77	0.76	0.75	0.75	0.73	0.73	0.73	0.74	0.75	0.75	0.76
------	------	------	------	------	------	------	------	------	------	------	------

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

0.75 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.84 (42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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
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(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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
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(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=	28.7	25.49	20.73	15.7	11.73	9.91	10.7	13.91	18.67	23.71	27.67	29.5
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(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
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(72)

Total internal gains =

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

(73)m=	496.18	493.52	476.58	449.39	421.52	395.21	378.55	385.47	399.87	427.3	458.61	482.33
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(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 m ²		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	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)

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	1.76	x	46.75	x	0.63	x	0.7	=	25.15	(78)
South	0.9x	0.77	x	2.73	x	46.75	x	0.63	x	0.7	=	39.01	(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	2.73	x	76.57	x	0.63	x	0.7	=	63.88	(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	2.73	x	97.53	x	0.63	x	0.7	=	81.37	(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	2.73	x	110.23	x	0.63	x	0.7	=	91.97	(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	2.73	x	114.87	x	0.63	x	0.7	=	95.84	(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	2.73	x	110.55	x	0.63	x	0.7	=	92.23	(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	2.73	x	108.01	x	0.63	x	0.7	=	90.12	(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	2.73	x	104.89	x	0.63	x	0.7	=	87.52	(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	2.73	x	101.89	x	0.63	x	0.7	=	85.01	(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	2.73	x	82.59	x	0.63	x	0.7	=	68.9	(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	2.73	x	55.42	x	0.63	x	0.7	=	46.24	(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	2.73	x	40.4	x	0.63	x	0.7	=	33.71	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 87.03 148.79 208.13 270.6 318.38 323.78 308.88 271.41 229.13 165.37 104.27 74.51 (83)

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

(84)m= 583.21 642.3 684.71 719.99 739.9 719 687.43 656.88 629 592.67 562.88 556.84 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

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

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(86)m=	1	1	0.99	0.97	0.89	0.71	0.53	0.58	0.83	0.97	0.99	1	(86)
--------	---	---	------	------	------	------	------	------	------	------	------	---	------

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

(87)m=	20.08	20.2	20.39	20.64	20.86	20.97	21	20.99	20.93	20.67	20.34	20.06	(87)
--------	-------	------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	------

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

(88)m=	20.28	20.28	20.29	20.3	20.3	20.31	20.31	20.32	20.31	20.3	20.3	20.29	(88)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	------	-------	------

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

(89)m=	1	0.99	0.99	0.96	0.86	0.65	0.45	0.5	0.77	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=	19.03	19.2	19.48	19.85	20.15	20.29	20.31	20.31	20.25	19.9	19.42	19.01	(90)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) =	0.29	(91)
---------------------------	------	------

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

(92)m=	19.33	19.49	19.74	20.08	20.35	20.49	20.51	20.51	20.44	20.12	19.68	19.31	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.33	19.49	19.74	20.08	20.35	20.49	20.51	20.51	20.44	20.12	19.68	19.31	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.86	0.67	0.48	0.52	0.79	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	580.85	637.3	672.85	685.03	637.51	479.76	327.49	341.83	494.68	567.55	557.97	555.1	(95)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm, W = [(39)m × ((93)m – (96)m)]

(97)m=	1330.29	1286.43	1163.1	963.82	742.86	496.06	329.24	344.76	538.71	817.94	1088.74	1317.99	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	557.58	436.22	364.75	200.73	78.38	0	0	0	0	186.29	382.16	567.59	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2773.69	(99)
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Space heating requirement in kWh/m²/year

24.07	(99)
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9b. Energy requirements – Community heating scheme

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

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

0	(301)
---	-------

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

1	(302)
---	-------

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

Fraction of heat from Community heat pump

1	(303a)
---	--------

Fraction of total space heat from Community heat pump

(302) × (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

Annual space heating requirement

kWh/year

2773.69

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Space heat from Community heat pump	$(98) \times (304a) \times (305) \times (306) =$	2912.37	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		2134.92	
If DHW from community scheme:			
Water heat from Community heat pump	$(64) \times (303a) \times (305) \times (306) =$	2241.66	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	51.54	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	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)		506.92	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5907.67	(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		250	(367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	=	1069.98 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	26.75 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	1096.73 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			1096.73 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	=	128.05 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	=	263.09 (379)
Total CO2, kg/year	sum of (376)...(382) =			1487.87 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			12.91 (384)
EI rating (section 14)				87.56 (385)

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 3

Address : Flat_3

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
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	m ³ 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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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)
Floor			78.11	x 0.12	= 9.373199	110	8592.1 (28)
Walls Type1	55.27	12.92	42.35	x 0.18	= 7.62	70	2964.5 (29)
Walls Type2	8.1	0	8.1	x 0.23	= 1.89	70	567 (29)
Walls Type3	23.44	1.89	21.55	x 0.23	= 5.04	70	1508.5 (29)
Total area of elements, m²			164.92				(31)
Party wall			23.73	x 0	= 0	45	1067.85 (32)
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) = 43.7 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 17939.95 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 229.68 (35)

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

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can be used instead of a detailed calculation.

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

14.24 (36)

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

Total fabric heat loss

(33) + (36) =

57.94 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

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

77.44	77.21	76.99	75.88	75.66	74.55	74.55	74.33	75	75.66	76.1	76.55
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Average = Sum(39)_{1...12} / 12 =

75.83 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.99	0.99	0.99	0.97	0.97	0.95	0.95	0.95	0.96	0.97	0.97	0.98
------	------	------	------	------	------	------	------	------	------	------	------

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

0.97 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.43 (42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

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

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²		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)

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)

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=	0.99	0.99	0.97	0.91	0.78	0.6	0.44	0.47	0.72	0.93	0.99	1	(86)

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

(87)m=	19.99	20.16	20.42	20.71	20.9	20.98	21	21	20.95	20.69	20.29	19.96	(87)
--------	-------	-------	-------	-------	------	-------	----	----	-------	-------	-------	-------	------

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

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

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

(89)m=	0.99	0.98	0.96	0.88	0.73	0.52	0.35	0.39	0.65	0.91	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.74	19	19.36	19.77	20.01	20.11	20.12	20.12	20.08	19.76	19.19	18.7	(90)
--------	-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =

0.37 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	19.2	19.43	19.75	20.12	20.34	20.43	20.45	20.45	20.4	20.11	19.6	19.17	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------	------

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

(93)m=	19.2	19.43	19.75	20.12	20.34	20.43	20.45	20.45	20.4	20.11	19.6	19.17	(93)
--------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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	0.95	0.88	0.75	0.55	0.38	0.42	0.67	0.91	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=	527	609.25	667.46	677.68	598.6	426.75	285.78	299.22	449.39	542.8	517.22	498.86	(95)
--------	-----	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	1154.09	1122.18	1020.51	851.19	653.91	434.91	286.72	300.77	472.78	719.51	950.93	1145.82	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	466.56	344.69	262.67	124.93	41.15	0	0	0	0	131.47	312.27	481.34	
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1...5,9...12} =$ 2165.08 (98)

Space heating requirement in $kWh/m^2/year$

27.72 (99)

9b. Energy requirements – Community heating scheme

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

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

0 (301)

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

1 (302)

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

Fraction of heat from Community heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) $\times$ (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

Annual space heating requirement

kWh/year

2165.08

Space heat from Community heat pump

(98) $\times$ (304a) $\times$ (305) $\times$ (306) =

2273.33 (307a)

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

0 (308)

Space heating requirement from secondary/supplementary system

(98) $\times$ (301) $\times$ 100 $\div$ (308) =

0 (309)

Water heating

Annual water heating requirement

1979.16

If DHW from community scheme:

Water heat from Community heat pump

(64) $\times$ (303a) $\times$ (305) $\times$ (306) =

2078.12 (310a)

Electricity used for heat distribution

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

43.51 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) $\div$ (314) =

0 (315)

DER WorkSheet: New dwelling design stage

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

mechanical ventilation - balanced, extract or positive input from outside

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) =

4870.31 (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		250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 903.36 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 22.58 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 925.95 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		925.95 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 86.8 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 182.49 (379)
Total CO2, kg/year	sum of (376)...(382) =		1195.23 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		15.3 (384)
EI rating (section 14)			86.99 (385)

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 4

Address : Flat_4

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	69.91 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	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					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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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 **			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) = 39.36 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16184.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 231.51 (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)

DER WorkSheet: New dwelling design stage

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 x (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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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 than 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=	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)

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

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)

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

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

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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
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 (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 × [(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
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
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 (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
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 (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
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 (73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²		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)
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)
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)

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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	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)

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)
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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=	19.95	20.09	20.34	20.65	20.88	20.98	21	20.99	20.93	20.63	20.24	19.93	(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=	1	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=	18.69	18.9	19.25	19.71	20	20.11	20.12	20.13	20.07	19.68	19.12	18.67	(90)
--------	-------	------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.57 (91)

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

(92)m=	19.41	19.58	19.87	20.25	20.51	20.61	20.62	20.62	20.56	20.22	19.76	19.39	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.41	19.58	19.87	20.25	20.51	20.61	20.62	20.62	20.56	20.22	19.76	19.39	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.92	0.79	0.58	0.42	0.47	0.75	0.95	0.99	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	439.37	488.67	539.71	573.3	530.11	388.94	265.64	276.91	396.25	441.9	423.56	419.76	(95)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

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

(97)m=	1041.71	1008.95	916.43	766.47	592.96	398.63	266.93	279.3	431.19	647.89	857.38	1034.92	(97)
--------	---------	---------	--------	--------	--------	--------	--------	-------	--------	--------	--------	---------	------

DER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	448.14	349.63	280.28	139.08	46.76	0	0	0	0	153.26	312.35	457.67
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total per year (kWh/year) = $\text{Sum}(98)_{1...5,9...12} =$ 2187.16 (98)

Space heating requirement in kWh/m²/year

31.29 (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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) x (303a) = 1 (304a)

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

1 (305)

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

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2187.16

Space heat from Community heat pump

(98) x (304a) x (305) x (306) = 2296.52 (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 heat pump

(64) x (303a) x (305) x (306) = 2006.68 (310a)

Electricity used for heat distribution

$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$ 43.03 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 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) =

4776.76 (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		250 (367a)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	=	893.34	(367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	22.33	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	915.68	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			915.68	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	77.69	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	168.09	(379)
Total CO2, kg/year	sum of (376)...(382) =			1161.46	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			16.61	(384)
EI rating (section 14)				86.46	(385)

DRAFT

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 5

Address : Flat_5

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	65.62 (1a)	2.7 (2a)	177.17 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.62 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	177.17 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	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
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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)
Floor			65.62	x 0.12	= 7.8744	110	7218.2 (28)
Walls Type1	41.2	7.34	33.86	x 0.18	= 6.09	70	2370.2 (29)
Walls Type2	5.08	1.89	3.19	x 0.23	= 0.75	70	223.3 (29)
Total area of elements, m²			111.9				(31)
Party wall			41.36	x 0	= 0	45	1861.2 (32)
Party ceiling			65.62			30	1968.6 (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) = 27.09 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14181.5 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 216.12 (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 10.28 (36)

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

Total fabric heat loss (33) + (36) = 37.37 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	16.37	16.19	16	15.07	14.88	13.95	13.95	13.77	14.32	14.88	15.26	15.63	(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=	53.75	53.56	53.37	52.44	52.25	51.32	51.32	51.14	51.7	52.25	52.63	53	
Average = Sum(39) _{1...12} /12=												52.39	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.82	0.81	0.8	0.8	0.78	0.78	0.78	0.79	0.8	0.8	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

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

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

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	93.4	90.01	86.61	83.21	79.82	76.42	76.42	79.82	83.21	86.61	90.01	93.4	
Total = Sum(44) _{1...12} =												1018.96	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	138.52	121.15	125.01	108.99	104.58	90.24	83.62	95.96	97.1	113.17	123.53	134.15	
Total = Sum(45) _{1...12} =												1336.01	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	20.78	18.17	18.75	16.35	15.69	13.54	12.54	14.39	14.57	16.97	18.53	20.12	(46)

Water storage loss:

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

	120	(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):

Temperature factor from Table 2b

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

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

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

If community heating see section 4.3

Volume factor from Table 2a

Temperature factor from Table 2b

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

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

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

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

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m × [(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
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 (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
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 (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
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 (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=

183.91	162.15	170.41	152.92	149.97	134.17	129.02	141.36	141.04	158.56	167.46	179.54
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 (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=

183.91	162.15	170.41	152.92	149.97	134.17	129.02	141.36	141.04	158.56	167.46	179.54
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Output from water heater (annual) ^{1...12}	1870.52
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 (64)

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

(65)m=

82.37	73.08	77.88	71.38	71.09	65.15	64.12	68.22	67.43	73.94	76.22	80.92
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
106.76	106.76	106.76	106.76	106.76	106.76	106.76	106.76	106.76	106.76	106.76	106.76

 (66)

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

(67)m=

18.78	16.68	13.56	10.27	7.68	6.48	7	9.1	12.22	15.51	18.11	19.3
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 (67)

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

(68)m=

186.87	188.81	183.92	173.52	160.39	148.04	139.8	137.86	142.75	153.15	166.28	178.62
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 (68)

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

(69)m=

33.68	33.68	33.68	33.68	33.68	33.68	33.68	33.68	33.68	33.68	33.68	33.68
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 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (70)

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

(71)m=

-85.41	-85.41	-85.41	-85.41	-85.41	-85.41	-85.41	-85.41	-85.41	-85.41	-85.41	-85.41
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

110.72	108.76	104.68	99.15	95.55	90.49	86.19	91.7	93.66	99.39	105.86	108.76
--------	--------	--------	-------	-------	-------	-------	------	-------	-------	--------	--------

 (72)

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

(73)m=

371.39	369.27	357.2	337.96	318.64	300.04	288.02	293.69	303.65	323.08	345.28	361.72
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

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	10.63	x	0.63	x	0.7	=	12.41	(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	20.32	x	0.63	x	0.7	=	23.72	(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	34.53	x	0.63	x	0.7	=	40.31	(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	55.46	x	0.63	x	0.7	=	64.75	(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	74.72	x	0.63	x	0.7	=	87.23	(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	79.99	x	0.63	x	0.7	=	93.38	(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	74.68	x	0.63	x	0.7	=	87.18	(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	59.25	x	0.63	x	0.7	=	69.17	(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	41.52	x	0.63	x	0.7	=	48.47	(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	24.19	x	0.63	x	0.7	=	28.24	(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	13.12	x	0.63	x	0.7	=	15.31	(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	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	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	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	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	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	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	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

(83)m= 43.28 75.84 111.35 153.88 189.2 195.86 185.44 157.45 125.6 85.67 52.18 36.85 (83)

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

(84)m= 414.67 445.11 468.54 491.84 507.84 495.9 473.46 451.14 429.25 408.75 397.45 398.56 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

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

DER WorkSheet: New dwelling design stage

(86)m=	0.99	0.99	0.98	0.94	0.84	0.64	0.47	0.52	0.77	0.95	0.99	1	(86)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(87)m=	20.17	20.27	20.46	20.7	20.9	20.98	21	21	20.95	20.73	20.42	20.15	(87)
--------	-------	-------	-------	------	------	-------	----	----	-------	-------	-------	-------	------

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

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

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

(89)m=	0.99	0.99	0.97	0.93	0.8	0.58	0.4	0.44	0.71	0.93	0.98	0.99	(89)
--------	------	------	------	------	-----	------	-----	------	------	------	------	------	------

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

(90)m=	19.12	19.28	19.54	19.9	20.15	20.26	20.27	20.27	20.23	19.94	19.49	19.1	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =	0.5	(91)
---------------------------	-----	------

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

(92)m=	19.64	19.78	20	20.3	20.53	20.62	20.63	20.64	20.59	20.34	19.96	19.63	(92)
--------	-------	-------	----	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.64	19.78	20	20.3	20.53	20.62	20.63	20.64	20.59	20.34	19.96	19.63	(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=	0.99	0.99	0.97	0.93	0.81	0.61	0.44	0.48	0.74	0.93	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	411.04	438.68	455.05	455.66	412.98	302.39	206.34	215.31	315.71	381.41	390.51	395.71	(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 × [(93)m – (96)m]

(97)m=	824.69	796.89	720.67	598.03	461.15	309.08	207.08	216.56	335.58	508.9	676.57	817.67	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

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

(98)m=	307.75	240.72	197.63	102.5	35.84	0	0	0	0	94.85	205.96	313.93	(98)
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1499.19	(99)
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Space heating requirement in kWh/m²/year

22.85	(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)
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Fraction of space heat from community system 1 – (301) =

1	(302)
---	-------

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

Fraction of heat from Community heat pump

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

(302) × (303a) =	1	(304a)
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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)
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Space heating

Annual space heating requirement

kWh/year

1499.19

DER WorkSheet: New dwelling design stage

Space heat from Community heat pump	$(98) \times (304a) \times (305) \times (306) =$	1574.15	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		1870.52	
If DHW from community scheme:			
Water heat from Community heat pump	$(64) \times (303a) \times (305) \times (306) =$	1964.05	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	35.38	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		140.5	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	140.5	(331)
Energy for lighting (calculated in Appendix L)		331.65	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4010.35	(338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)				
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		250	(367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	=	734.53 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	18.36 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	752.89 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			752.89 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	=	72.92 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	=	172.13 (379)
Total CO2, kg/year	sum of (376)...(382) =			997.94 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			15.21 (384)
El rating (section 14)				87.91 (385)

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 6

Address : Flat_6

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	65.36 (1a) x	2.7 (2a) =	176.47 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.36 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.47 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
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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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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)
Floor			65.36	x 0.12	= 7.8432	110	7189.6 (28)
Walls Type1	41.04	7.34	33.7	x 0.18	= 6.07	70	2359 (29)
Walls Type2	5.08	1.89	3.19	x 0.23	= 0.75	70	223.3 (29)
Total area of elements, m²			111.48				(31)
Party wall			41.36	x 0	= 0	45	1861.2 (32)
Party ceiling			65.36			30	1960.8 (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) = 27.03 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14133.9 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 216.25 (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 10.26 (36)

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

Total fabric heat loss (33) + (36) = 37.3 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
16.31	16.12	15.94	15.01	14.82	13.9	13.9	13.71	14.27	14.82	15.2	15.57

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

53.61	53.42	53.24	52.31	52.12	51.19	51.19	51.01	51.56	52.12	52.49	52.86
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$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

52.26

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.82	0.82	0.81	0.8	0.8	0.78	0.78	0.78	0.79	0.8	0.8	0.81
------	------	------	-----	-----	------	------	------	------	-----	-----	------

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

0.8

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.13

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

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

84.75

(43)

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

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
93.23	89.84	86.45	83.06	79.67	76.28	76.28	79.67	83.06	86.45	89.84	93.23

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

1017.01

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

138.25	120.92	124.77	108.78	104.38	90.07	83.46	95.77	96.92	112.95	123.29	133.89
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$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1333.46

(45)

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

(46)m=

20.74	18.14	18.72	16.32	15.66	13.51	12.52	14.37	14.54	16.94	18.49	20.08
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(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.71

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m × [(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=

183.65	161.92	170.17	152.71	149.77	134	128.86	141.17	140.85	158.35	167.23	179.28
--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------

 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (63)

Output from water heater

(64)m=

183.65	161.92	170.17	152.71	149.77	134	128.86	141.17	140.85	158.35	167.23	179.28
--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1867.96
---	---------

 (64)

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

(65)m=

82.29	73.01	77.8	71.32	71.02	65.09	64.07	68.16	67.37	73.87	76.14	80.84
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
106.42	106.42	106.42	106.42	106.42	106.42	106.42	106.42	106.42	106.42	106.42	106.42

 (66)

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

(67)m=

18.7	16.61	13.51	10.23	7.64	6.45	6.97	9.06	12.17	15.45	18.03	19.22
------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

 (67)

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

(68)m=

186.24	188.17	183.3	172.93	159.84	147.54	139.33	137.39	142.26	152.63	165.72	178.02
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-85.14	-85.14	-85.14	-85.14	-85.14	-85.14	-85.14	-85.14	-85.14	-85.14	-85.14	-85.14
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

110.6	108.64	104.58	99.05	95.46	90.41	86.11	91.62	93.57	99.29	105.75	108.65
-------	--------	--------	-------	-------	-------	-------	-------	-------	-------	--------	--------

 (72)

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

(73)m=

370.46	368.34	356.31	337.13	317.87	299.33	287.34	293	302.93	322.3	344.42	360.81
--------	--------	--------	--------	--------	--------	--------	-----	--------	-------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

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	10.63	x	0.63	x	0.7	=	12.41	(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	20.32	x	0.63	x	0.7	=	23.72	(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	34.53	x	0.63	x	0.7	=	40.31	(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	55.46	x	0.63	x	0.7	=	64.75	(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	74.72	x	0.63	x	0.7	=	87.23	(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	79.99	x	0.63	x	0.7	=	93.38	(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	74.68	x	0.63	x	0.7	=	87.18	(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	59.25	x	0.63	x	0.7	=	69.17	(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	41.52	x	0.63	x	0.7	=	48.47	(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	24.19	x	0.63	x	0.7	=	28.24	(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	13.12	x	0.63	x	0.7	=	15.31	(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	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	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	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	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	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	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	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

(83)m= 43.28 75.84 111.35 153.88 189.2 195.86 185.44 157.45 125.6 85.67 52.18 36.85 (83)

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

(84)m= 413.74 444.18 467.65 491.01 507.08 495.19 472.78 450.45 428.53 407.97 396.6 397.66 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

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

DER WorkSheet: New dwelling design stage

(86)m=	0.99	0.99	0.98	0.94	0.84	0.64	0.47	0.52	0.77	0.95	0.99	1	(86)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(87)m=	20.17	20.27	20.46	20.7	20.9	20.98	21	21	20.95	20.73	20.42	20.15	(87)
--------	-------	-------	-------	------	------	-------	----	----	-------	-------	-------	-------	------

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

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

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

(89)m=	0.99	0.99	0.97	0.92	0.8	0.58	0.4	0.44	0.71	0.93	0.98	0.99	(89)
--------	------	------	------	------	-----	------	-----	------	------	------	------	------	------

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

(90)m=	19.12	19.28	19.54	19.9	20.15	20.26	20.27	20.27	20.22	19.94	19.49	19.1	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =	0.5	(91)
---------------------------	-----	------

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

(92)m=	19.65	19.78	20	20.31	20.53	20.62	20.64	20.64	20.59	20.34	19.96	19.63	(92)
--------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.65	19.78	20	20.31	20.53	20.62	20.64	20.64	20.59	20.34	19.96	19.63	(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=	0.99	0.99	0.97	0.93	0.81	0.61	0.44	0.48	0.74	0.93	0.98	0.99	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	410.1	437.74	454.13	454.75	412.09	301.7	205.87	214.82	314.99	380.6	389.65	394.81	(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 × [(93)m – (96)m]

(97)m=	822.63	794.91	718.9	596.58	460.05	308.36	206.61	216.07	334.79	507.68	674.91	815.64	(97)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(98)m=	306.92	240.02	196.99	102.12	35.68	0	0	0	0	94.55	205.39	313.1	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	-------	--------	-------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1494.76	(99)
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Space heating requirement in kWh/m²/year

22.87	(99)
-------	------

9b. Energy requirements – Community heating scheme

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

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

0	(301)
---	-------

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

1	(302)
---	-------

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

Fraction of heat from Community heat pump

1	(303a)
---	--------

Fraction of total space heat from Community heat pump

(302) × (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

Annual space heating requirement

kWh/year	
1494.76	

DER WorkSheet: New dwelling design stage

Space heat from Community heat pump	$(98) \times (304a) \times (305) \times (306) =$	1569.5	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		1867.96	
If DHW from community scheme:			
Water heat from Community heat pump	$(64) \times (303a) \times (305) \times (306) =$	1961.36	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	35.31	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		139.94	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	139.94	(331)
Energy for lighting (calculated in Appendix L)		330.25	(332)
Total delivered energy for all uses $(307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =$		4001.05	(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			250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	=	733.01 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	18.33 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	751.33 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			751.33 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	=	72.63 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	=	171.4 (379)
Total CO2, kg/year	sum of (376)...(382) =			995.36 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			15.23 (384)
EI rating (section 14)				87.91 (385)

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(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	69.91 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	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	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)
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If no draught lobby, enter 0.05, else enter 0	0 (13)
---	--------

Percentage of windows and doors draught stripped	0 (14)
--	--------

Window infiltration	0 (15)
---------------------	--------

Infiltration rate	0 (16)
-------------------	--------

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)
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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	0.85 (20)
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Infiltration rate incorporating shelter factor	0.13 (21)
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Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

0.16	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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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 x (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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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 than 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=	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)

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

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)

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

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

$$((56)m = (55) \times (41)m$$

(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 × [(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

(66)m=

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²		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 = $0.024 \times [(97)m - (95)m] \times (41)m$

(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/m ² /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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) x (303a) = 1 (304a)

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

1 (305)

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

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

2181.13

Space heat from Community heat pump

(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 heat pump

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

2006.68 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 42.97 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 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		250 (367a)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	=	892.03	(367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	22.3	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	914.33	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			914.33	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	77.69	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	168.09	(379)
Total CO2, kg/year	sum of (376)...(382) =			1160.11	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			16.59	(384)
EI rating (section 14)				86.47	(385)

DRAFT

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(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	88.4 (1a)	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	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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)

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

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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 x (25)m x (5)

(38)m=

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

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

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

2.6 (42)

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 than 125 litres per person per day (all water use, hot and cold)

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

(44)m=

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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.71

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(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 × [(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 $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 m ²	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)

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)
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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)

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	1	0.99	0.97	0.92	0.81	0.62	0.45	0.49	0.74	0.94	0.99	1	

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)
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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)
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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

DER WorkSheet: New dwelling design stage

(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 T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(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, $h_m G_m$, $W = (94)m \times (84)m$

(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(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, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	506.56	378.07	292.66	142.69	48.32	0	0	0	0	147.24	340.88	521.36	
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Total per year ($kWh/year$) = $Sum(98)_{1...5,9...12} =$ 2377.78 (98)

Space heating requirement in $kWh/m^2/year$

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 heat pump

1 (303a)

Fraction of total space heat from Community heat pump

(302) x (303a) =

1 (304a)

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

1 (305)

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

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

2377.78

Space heat from Community heat pump

(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 heat pump

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

2147.63 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

46.44 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$

0 (315)

DER WorkSheet: New dwelling design stage

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

mechanical ventilation - balanced, extract or positive input from outside

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		250 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 964.16 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 24.1 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 988.26 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		988.26 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 98.23 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 205.07 (379)
Total CO2, kg/year	sum of (376)...(382) =		1291.56 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		14.61 (384)
EI rating (section 14)			87.03 (385)