

DER WorkSheet: New dwelling design stage

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

12.8 (36)

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

Total fabric heat loss

(33) + (36) =

72.98 (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=	26.12	25.82	25.51	23.99	23.68	22.16	22.16	21.86	22.77	23.68	24.29	24.9

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	99.1	98.8	98.49	96.97	96.66	95.14	95.14	94.84	95.75	96.66	97.27	97.88
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Average = Sum(39)₁₋₁₂ / 12 =

96.89 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=	1.17	1.17	1.17	1.15	1.14	1.13	1.13	1.12	1.13	1.14	1.15	1.16
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Average = Sum(40)₁₋₁₂ / 12 =

1.15 (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

2.54 (42)

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

94.56 (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
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Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	104.02	100.24	96.45	92.67	88.89	85.11	85.11	88.89	92.67	96.45	100.24	104.02
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Total = Sum(44)₁₋₁₂ =

1134.76 (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=	154.26	134.91	139.22	121.38	116.46	100.5	93.13	106.86	108.14	126.03	137.57	149.39
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Total = Sum(45)₁₋₁₂ =

1487.84 (45)

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

(46)m=	23.14	20.24	20.88	18.21	17.47	15.07	13.97	16.03	16.22	18.9	20.64	22.41
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(46)

Water storage loss:

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

0 (47)

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

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

Water storage loss:

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

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

0 (50)

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

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

0 (51)

If community heating see section 4.3

Volume factor from Table 2a

0 (52)

Temperature factor from Table 2b

0 (53)

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

0
0

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

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

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
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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=

0	0	0	0	0	0	0	0	0	0	0	0
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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 x (41)m

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

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
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(59)

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

(61)m=

50.96	46.03	49.15	45.7	45.3	41.97	43.37	45.3	45.7	49.15	49.32	50.96
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(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=

205.22	180.94	188.37	167.08	161.76	142.47	136.5	152.16	153.84	175.18	186.88	200.35
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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=

205.22	180.94	188.37	167.08	161.76	142.47	136.5	152.16	153.84	175.18	186.88	200.35
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(64)
Output from water heater (annual)_{1 12}

2050.74

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=

64.03	56.37	58.58	51.78	50.05	43.91	41.81	46.86	47.38	54.19	58.07	62.41
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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
127.08	127.08	127.08	127.08	127.08	127.08	127.08	127.08	127.08	127.08	127.08	127.08

(66)

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

(67)m=

20.37	18.09	14.71	11.14	8.33	7.03	7.59	9.87	13.25	16.82	19.64	20.93
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(67)

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

(68)m=

228.45	230.82	224.85	212.13	196.08	180.99	170.91	168.54	174.51	187.23	203.29	218.37
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(68)

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

(69)m=

35.71	35.71	35.71	35.71	35.71	35.71	35.71	35.71	35.71	35.71	35.71	35.71
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(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
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(70)

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

(71)m=

-101.66	-101.66	-101.66	-101.66	-101.66	-101.66	-101.66	-101.66	-101.66	-101.66	-101.66	-101.66
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(71)

Water heating gains (Table 5)

(72)m=

86.06	83.88	78.73	71.92	67.27	60.98	56.19	62.98	65.81	72.84	80.65	83.89
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(72)

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

(73)m=

399.01	396.92	382.42	359.31	335.8	313.13	298.82	305.51	317.7	341.02	367.7	387.32
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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)	
Northeast 0.9x	0.77	x	9.56	x	11.28	x	0.55	x	0.7	=	28.78	(75)
Northeast 0.9x	0.77	x	4.65	x	11.28	x	0.55	x	0.7	=	14	(75)
Northeast 0.9x	0.77	x	9.56	x	22.97	x	0.55	x	0.7	=	58.58	(75)
Northeast 0.9x	0.77	x	4.65	x	22.97	x	0.55	x	0.7	=	28.49	(75)
Northeast 0.9x	0.77	x	9.56	x	41.38	x	0.55	x	0.7	=	105.54	(75)
Northeast 0.9x	0.77	x	4.65	x	41.38	x	0.55	x	0.7	=	51.34	(75)
Northeast 0.9x	0.77	x	9.56	x	67.96	x	0.55	x	0.7	=	173.33	(75)
Northeast 0.9x	0.77	x	4.65	x	67.96	x	0.55	x	0.7	=	84.31	(75)
Northeast 0.9x	0.77	x	9.56	x	91.35	x	0.55	x	0.7	=	232.99	(75)
Northeast 0.9x	0.77	x	4.65	x	91.35	x	0.55	x	0.7	=	113.33	(75)
Northeast 0.9x	0.77	x	9.56	x	97.38	x	0.55	x	0.7	=	248.39	(75)
Northeast 0.9x	0.77	x	4.65	x	97.38	x	0.55	x	0.7	=	120.82	(75)
Northeast 0.9x	0.77	x	9.56	x	91.1	x	0.55	x	0.7	=	232.37	(75)
Northeast 0.9x	0.77	x	4.65	x	91.1	x	0.55	x	0.7	=	113.02	(75)
Northeast 0.9x	0.77	x	9.56	x	72.63	x	0.55	x	0.7	=	185.25	(75)
Northeast 0.9x	0.77	x	4.65	x	72.63	x	0.55	x	0.7	=	90.1	(75)
Northeast 0.9x	0.77	x	9.56	x	50.42	x	0.55	x	0.7	=	128.61	(75)
Northeast 0.9x	0.77	x	4.65	x	50.42	x	0.55	x	0.7	=	62.55	(75)
Northeast 0.9x	0.77	x	9.56	x	28.07	x	0.55	x	0.7	=	71.59	(75)
Northeast 0.9x	0.77	x	4.65	x	28.07	x	0.55	x	0.7	=	34.82	(75)
Northeast 0.9x	0.77	x	9.56	x	14.2	x	0.55	x	0.7	=	36.21	(75)
Northeast 0.9x	0.77	x	4.65	x	14.2	x	0.55	x	0.7	=	17.61	(75)
Northeast 0.9x	0.77	x	9.56	x	9.21	x	0.55	x	0.7	=	23.5	(75)
Northeast 0.9x	0.77	x	4.65	x	9.21	x	0.55	x	0.7	=	11.43	(75)
Southwest 0.9x	0.77	x	2.3	x	36.79		0.55	x	0.7	=	22.58	(79)
Southwest 0.9x	0.77	x	2.3	x	62.67		0.55	x	0.7	=	38.46	(79)
Southwest 0.9x	0.77	x	2.3	x	85.75		0.55	x	0.7	=	52.62	(79)
Southwest 0.9x	0.77	x	2.3	x	106.25		0.55	x	0.7	=	65.2	(79)
Southwest 0.9x	0.77	x	2.3	x	119.01		0.55	x	0.7	=	73.03	(79)
Southwest 0.9x	0.77	x	2.3	x	118.15		0.55	x	0.7	=	72.5	(79)
Southwest 0.9x	0.77	x	2.3	x	113.91		0.55	x	0.7	=	69.9	(79)
Southwest 0.9x	0.77	x	2.3	x	104.39		0.55	x	0.7	=	64.06	(79)
Southwest 0.9x	0.77	x	2.3	x	92.85		0.55	x	0.7	=	56.98	(79)
Southwest 0.9x	0.77	x	2.3	x	69.27		0.55	x	0.7	=	42.51	(79)
Southwest 0.9x	0.77	x	2.3	x	44.07		0.55	x	0.7	=	27.04	(79)
Southwest 0.9x	0.77	x	2.3	x	31.49		0.55	x	0.7	=	19.32	(79)
Northwest 0.9x	0.77	x	8.51	x	11.28	x	0.55	x	0.7	=	25.62	(81)
Northwest 0.9x	0.77	x	9.45	x	11.28	x	0.55	x	0.7	=	28.45	(81)
Northwest 0.9x	0.77	x	8.51	x	22.97	x	0.55	x	0.7	=	52.15	(81)

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Northwest 0.9x	0.77	x	9.45	x	22.97	x	0.55	x	0.7	=	57.91	(81)
Northwest 0.9x	0.77	x	8.51	x	41.38	x	0.55	x	0.7	=	93.95	(81)
Northwest 0.9x	0.77	x	9.45	x	41.38	x	0.55	x	0.7	=	104.33	(81)
Northwest 0.9x	0.77	x	8.51	x	67.96	x	0.55	x	0.7	=	154.29	(81)
Northwest 0.9x	0.77	x	9.45	x	67.96	x	0.55	x	0.7	=	171.34	(81)
Northwest 0.9x	0.77	x	8.51	x	91.35	x	0.55	x	0.7	=	207.4	(81)
Northwest 0.9x	0.77	x	9.45	x	91.35	x	0.55	x	0.7	=	230.31	(81)
Northwest 0.9x	0.77	x	8.51	x	97.38	x	0.55	x	0.7	=	221.11	(81)
Northwest 0.9x	0.77	x	9.45	x	97.38	x	0.55	x	0.7	=	245.54	(81)
Northwest 0.9x	0.77	x	8.51	x	91.1	x	0.55	x	0.7	=	206.85	(81)
Northwest 0.9x	0.77	x	9.45	x	91.1	x	0.55	x	0.7	=	229.69	(81)
Northwest 0.9x	0.77	x	8.51	x	72.63	x	0.55	x	0.7	=	164.9	(81)
Northwest 0.9x	0.77	x	9.45	x	72.63	x	0.55	x	0.7	=	183.11	(81)
Northwest 0.9x	0.77	x	8.51	x	50.42	x	0.55	x	0.7	=	114.48	(81)
Northwest 0.9x	0.77	x	9.45	x	50.42	x	0.55	x	0.7	=	127.13	(81)
Northwest 0.9x	0.77	x	8.51	x	28.07	x	0.55	x	0.7	=	63.73	(81)
Northwest 0.9x	0.77	x	9.45	x	28.07	x	0.55	x	0.7	=	70.77	(81)
Northwest 0.9x	0.77	x	8.51	x	14.2	x	0.55	x	0.7	=	32.23	(81)
Northwest 0.9x	0.77	x	9.45	x	14.2	x	0.55	x	0.7	=	35.79	(81)
Northwest 0.9x	0.77	x	8.51	x	9.21	x	0.55	x	0.7	=	20.92	(81)
Northwest 0.9x	0.77	x	9.45	x	9.21	x	0.55	x	0.7	=	23.23	(81)

Solar gains in watts, calculated for each month

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

(83)m=	119.42	235.59	407.78	648.47	857.06	908.37	851.83	687.42	489.75	283.41	148.9	98.41	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	518.43	632.5	790.2	1007.79	1192.86	1221.49	1150.65	992.94	807.44	624.43	516.6	485.73	(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=	1	0.99	0.98	0.89	0.7	0.49	0.36	0.44	0.74	0.96	1	1	(86)

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

(87)m=	19.74	19.93	20.27	20.69	20.93	20.99	21	21	20.93	20.55	20.07	19.71	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.94	19.94	19.95	19.96	19.96	19.98	19.98	19.98	19.97	19.96	19.96	19.95	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.86	0.64	0.42	0.28	0.34	0.66	0.95	0.99	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.27	18.55	19.04	19.62	19.9	19.97	19.98	19.98	19.92	19.45	18.76	18.23	(90)
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fLA = Living area ÷ (4) =

0.25

(91)

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

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(92)m=	18.63	18.89	19.34	19.89	20.16	20.23	20.23	20.23	20.17	19.73	19.08	18.6	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.48	18.74	19.19	19.74	20.01	20.08	20.08	20.08	20.02	19.58	18.93	18.45	(93)
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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
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Utilisation factor for gains, h_m :

(94)m=	1	0.99	0.96	0.85	0.64	0.42	0.29	0.35	0.66	0.94	0.99	1	(94)
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Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	516.06	624.99	758.4	857.9	763.78	517.18	330.92	348.25	535.5	585.83	511.45	484.09	(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	1405.51	1367.78	1250.34	1051.2	803.03	521.05	331.33	349.32	567.26	867.65	1151.1	1395	(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=	661.75	499.15	366	139.17	29.2	0	0	0	0	209.67	460.55	677.72	
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Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 3043.22 (98)

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

36.04 (99)

8c. Space cooling requirement

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Heat loss rate L_m (calculated using $25^\circ C$ internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	894.31	704.03	720.75	0	0	0	0	(100)
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Utilisation factor for loss h_m

(101)m=	0	0	0	0	0	0.97	0.99	0.97	0	0	0	0	(101)
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Useful loss, $h_m L_m$ (Watts) = $(100)m \times (101)m$

(102)m=	0	0	0	0	0	868.42	694.32	701.69	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1514.04	1429.54	1246.32	0	0	0	0	(103)
---------	---	---	---	---	---	---------	---------	---------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$

set $(104)m$ to zero if $(104)m < 3 \times (98)m$

(104)m=	0	0	0	0	0	464.85	547	405.2	0	0	0	0	
---------	---	---	---	---	---	--------	-----	-------	---	---	---	---	--

Total = $Sum(104) =$ 1417.06 (104)

Cooled fraction

$f_C = \text{cooled area} \div (4) =$ 0.71 (105)

Intermittency factor (Table 10b)

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

Total = $Sum(104) =$ 0 (106)

Space cooling requirement for month = $(104)m \times (105) \times (106)m$

(107)m=	0	0	0	0	0	82.58	97.18	71.99	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = $Sum(107) =$ 251.75 (107)

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

$(107) \div (4) =$ 2.98 (108)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

DER WorkSheet: New dwelling design stage

Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		4.86	(209)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
661.75	499.15	366	139.17	29.2	0	0	0	0	209.67	460.55	677.72	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												
732.03	552.16	404.87	153.95	32.3	0	0	0	0	231.93	509.46	749.68	
Total (kWh/year) = Sum(211) _{1...5,10, 12} =												3366.39

Space heating fuel (secondary), kWh/month												
= {[(98)m x (201)] } x 100 ÷ (208)												
(215)m =	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1...5,10, 12} =												0

Water heating

Output from water heater (calculated above)	205.22	180.94	188.37	167.08	161.76	142.47	136.5	152.16	153.84	175.18	186.88	200.35
Efficiency of water heater												80.3
(217)m =	87.79	87.47	86.69	84.6	81.7	80.3	80.3	80.3	80.3	85.5	87.23	87.88
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m =	233.77	206.86	217.28	197.5	198	177.42	169.98	189.49	191.58	204.88	214.23	227.99
Total = Sum(219a) _{1...12} =												2428.98

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)												
(221)m =	0	0	0	0	0	16.99	20	14.81	0	0	0	0
Total = Sum(221) _{6...8} =												51.8

Annual totals

	kWh/year											kWh/year
Space heating fuel used, main system 1												3366.39
Water heating fuel used												2428.98
Space cooling fuel used												51.8
Electricity for pumps, fans and electric keep-hot												
mechanical ventilation - balanced, extract or positive input from outside											202.76	(230a)
central heating pump:											30	(230c)
Total electricity for the above, kWh/year	sum of (230a) (230g) =										232.76	(231)
Electricity for lighting											359.68	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 727.14

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1251.8	(265)
Space cooling	(221) x	0.519	=	26.88	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	120.8	(267)
Electricity for lighting	(232) x	0.519	=	186.68	(268)
Total CO2, kg/year	sum of (265) (271) =			1586.16	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			18.79	(273)
El rating (section 14)				84	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.10

Property Address: Flat 03

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Basement	63.22 (1a) x	2.7 (2a) =	170.69 (3a)
Ground floor	39.79 (1b) x	3.27 (2b) =	130.12 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	103.01 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	300.81 (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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
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)
<i>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</i>		
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)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.15 (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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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

	0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18
--	------	------	------	------	------	------	------	------	------	------	------	------

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) =

73.95 (23c)

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

(24a)m=	0.32	0.32	0.31	0.3	0.29	0.27	0.27	0.27	0.28	0.29	0.3	0.31	(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=	0.32	0.32	0.31	0.3	0.29	0.27	0.27	0.27	0.28	0.29	0.3	0.31	(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			8.51	$x1/[1/(1.2)+0.04] =$	9.74		(27)
Windows Type 2			2.3	$x1/[1/(1.2)+0.04] =$	2.63		(27)
Windows Type 3			9.45	$x1/[1/(1.2)+0.04] =$	10.82		(27)
Windows Type 4			6.41	$x1/[1/(1.2)+0.04] =$	7.34		(27)
Windows Type 5			2.3	$x1/[1/(1.2)+0.04] =$	2.63		(27)
Windows Type 6			2.3	$x1/[1/(1.2)+0.04] =$	2.63		(27)
Windows Type 7			4.65	$x1/[1/(1.2)+0.04] =$	5.32		(27)
Floor			63.22	x 0.1	6.322		(28)
Walls Type1	29.04	0	29.04	x 0.16	4.65		(29)
Walls Type2	80.83	35.92	44.91	x 0.16	7.19		(29)
Walls Type3	13.42	0	13.42	x 0.16	2.15		(29)
Roof	24.91	0	24.91	x 0.12	2.99		(30)
Total area of elements, m²			211.42				(31)

* 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) = 64.42 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 21566.03 (34)

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

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

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can be used instead of a detailed calculation.

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

13.7 (36)

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

Total fabric heat loss

(33) + (36) =

78.12 (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=	31.91	31.54	31.17	29.31	28.94	27.08	27.08	26.7	27.82	28.94	29.68	30.43

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	110.04	109.67	109.29	107.43	107.06	105.2	105.2	104.83	105.94	107.06	107.81	108.55
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Average = Sum(39)₁₋₁₂ / 12 =

107.34 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=	1.07	1.06	1.06	1.04	1.04	1.02	1.02	1.02	1.03	1.04	1.05	1.05
--------	------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)₁₋₁₂ / 12 =

1.04 (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

2.77

(42)

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

if TFA ≤ 13.9, N = 1

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

99.89

(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)

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

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

(44)m=	109.87	105.88	101.88	97.89	93.89	89.9	89.9	93.89	97.89	101.88	105.88	109.87
--------	--------	--------	--------	-------	-------	------	------	-------	-------	--------	--------	--------

Total = Sum(44)₁₋₁₂ =

1198.63 (44)

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

(45)m=	162.94	142.51	147.06	128.21	123.02	106.15	98.37	112.88	114.23	133.12	145.31	157.8
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------

Total = Sum(45)₁₋₁₂ =

1571.59 (45)

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

(46)m=	24.44	21.38	22.06	19.23	18.45	15.92	14.76	16.93	17.13	19.97	21.8	23.67
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(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$

0
0

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

0

 (55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (56)

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

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

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=

50.96	46.03	50.96	48.27	47.85	44.33	45.81	47.85	48.27	50.96	49.32	50.96
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 (61)

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

(62)m=

213.9	188.54	198.01	176.48	170.86	150.49	144.18	160.73	162.5	184.08	194.63	208.76
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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=

213.9	188.54	198.01	176.48	170.86	150.49	144.18	160.73	162.5	184.08	194.63	208.76
-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 $\text{Output from water heater (annual)}_{1-12}$

2153.15

 (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=

66.92	58.89	61.64	54.7	52.86	46.38	44.16	49.49	50.05	57	60.64	65.21
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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
138.29	138.29	138.29	138.29	138.29	138.29	138.29	138.29	138.29	138.29	138.29	138.29

 (66)

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

(67)m=

23.28	20.68	16.81	12.73	9.52	8.03	8.68	11.28	15.14	19.23	22.44	23.92
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 (67)

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

(68)m=

261.11	263.82	256.99	242.45	224.1	206.86	195.34	192.63	199.46	213.99	232.34	249.58
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

36.83	36.83	36.83	36.83	36.83	36.83	36.83	36.83	36.83	36.83	36.83	36.83
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

 (70)

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

(71)m=

-110.63	-110.63	-110.63	-110.63	-110.63	-110.63	-110.63	-110.63	-110.63	-110.63	-110.63	-110.63
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

89.94	87.64	82.84	75.97	71.06	64.42	59.35	66.52	69.51	76.62	84.23	87.64
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

441.81	439.61	424.13	398.64	372.16	346.79	330.86	337.92	351.6	377.32	406.5	428.64
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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)	
Northeast 0.9x	0.77	x	6.41	x	11.28	x	0.55	x	0.7	=	19.3	(75)
Northeast 0.9x	0.77	x	4.65	x	11.28	x	0.55	x	0.7	=	14	(75)
Northeast 0.9x	0.77	x	6.41	x	22.97	x	0.55	x	0.7	=	39.28	(75)
Northeast 0.9x	0.77	x	4.65	x	22.97	x	0.55	x	0.7	=	28.49	(75)
Northeast 0.9x	0.77	x	6.41	x	41.38	x	0.55	x	0.7	=	70.77	(75)
Northeast 0.9x	0.77	x	4.65	x	41.38	x	0.55	x	0.7	=	51.34	(75)
Northeast 0.9x	0.77	x	6.41	x	67.96	x	0.55	x	0.7	=	116.22	(75)
Northeast 0.9x	0.77	x	4.65	x	67.96	x	0.55	x	0.7	=	84.31	(75)
Northeast 0.9x	0.77	x	6.41	x	91.35	x	0.55	x	0.7	=	156.22	(75)
Northeast 0.9x	0.77	x	4.65	x	91.35	x	0.55	x	0.7	=	113.33	(75)
Northeast 0.9x	0.77	x	6.41	x	97.38	x	0.55	x	0.7	=	166.55	(75)
Northeast 0.9x	0.77	x	4.65	x	97.38	x	0.55	x	0.7	=	120.82	(75)
Northeast 0.9x	0.77	x	6.41	x	91.1	x	0.55	x	0.7	=	155.8	(75)
Northeast 0.9x	0.77	x	4.65	x	91.1	x	0.55	x	0.7	=	113.02	(75)
Northeast 0.9x	0.77	x	6.41	x	72.63	x	0.55	x	0.7	=	124.21	(75)
Northeast 0.9x	0.77	x	4.65	x	72.63	x	0.55	x	0.7	=	90.1	(75)
Northeast 0.9x	0.77	x	6.41	x	50.42	x	0.55	x	0.7	=	86.23	(75)
Northeast 0.9x	0.77	x	4.65	x	50.42	x	0.55	x	0.7	=	62.55	(75)
Northeast 0.9x	0.77	x	6.41	x	28.07	x	0.55	x	0.7	=	48	(75)
Northeast 0.9x	0.77	x	4.65	x	28.07	x	0.55	x	0.7	=	34.82	(75)
Northeast 0.9x	0.77	x	6.41	x	14.2	x	0.55	x	0.7	=	24.28	(75)
Northeast 0.9x	0.77	x	4.65	x	14.2	x	0.55	x	0.7	=	17.61	(75)
Northeast 0.9x	0.77	x	6.41	x	9.21	x	0.55	x	0.7	=	15.76	(75)
Northeast 0.9x	0.77	x	4.65	x	9.21	x	0.55	x	0.7	=	11.43	(75)
Southeast 0.9x	0.77	x	8.51	x	36.79	x	0.55	x	0.7	=	83.54	(77)
Southeast 0.9x	0.77	x	9.45	x	36.79	x	0.55	x	0.7	=	92.77	(77)
Southeast 0.9x	0.77	x	2.3	x	36.79	x	0.55	x	0.7	=	22.58	(77)
Southeast 0.9x	0.77	x	8.51	x	62.67	x	0.55	x	0.7	=	142.3	(77)
Southeast 0.9x	0.77	x	9.45	x	62.67	x	0.55	x	0.7	=	158.02	(77)
Southeast 0.9x	0.77	x	2.3	x	62.67	x	0.55	x	0.7	=	38.46	(77)
Southeast 0.9x	0.77	x	8.51	x	85.75	x	0.55	x	0.7	=	194.7	(77)
Southeast 0.9x	0.77	x	9.45	x	85.75	x	0.55	x	0.7	=	216.21	(77)
Southeast 0.9x	0.77	x	2.3	x	85.75	x	0.55	x	0.7	=	52.62	(77)
Southeast 0.9x	0.77	x	8.51	x	106.25	x	0.55	x	0.7	=	241.25	(77)
Southeast 0.9x	0.77	x	9.45	x	106.25	x	0.55	x	0.7	=	267.89	(77)
Southeast 0.9x	0.77	x	2.3	x	106.25	x	0.55	x	0.7	=	65.2	(77)
Southeast 0.9x	0.77	x	8.51	x	119.01	x	0.55	x	0.7	=	270.21	(77)
Southeast 0.9x	0.77	x	9.45	x	119.01	x	0.55	x	0.7	=	300.06	(77)
Southeast 0.9x	0.77	x	2.3	x	119.01	x	0.55	x	0.7	=	73.03	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	8.51	x	118.15	x	0.55	x	0.7	=	268.26	(77)
Southeast 0.9x	0.77	x	9.45	x	118.15	x	0.55	x	0.7	=	297.89	(77)
Southeast 0.9x	0.77	x	2.3	x	118.15	x	0.55	x	0.7	=	72.5	(77)
Southeast 0.9x	0.77	x	8.51	x	113.91	x	0.55	x	0.7	=	258.63	(77)
Southeast 0.9x	0.77	x	9.45	x	113.91	x	0.55	x	0.7	=	287.2	(77)
Southeast 0.9x	0.77	x	2.3	x	113.91	x	0.55	x	0.7	=	69.9	(77)
Southeast 0.9x	0.77	x	8.51	x	104.39	x	0.55	x	0.7	=	237.02	(77)
Southeast 0.9x	0.77	x	9.45	x	104.39	x	0.55	x	0.7	=	263.2	(77)
Southeast 0.9x	0.77	x	2.3	x	104.39	x	0.55	x	0.7	=	64.06	(77)
Southeast 0.9x	0.77	x	8.51	x	92.85	x	0.55	x	0.7	=	210.82	(77)
Southeast 0.9x	0.77	x	9.45	x	92.85	x	0.55	x	0.7	=	234.11	(77)
Southeast 0.9x	0.77	x	2.3	x	92.85	x	0.55	x	0.7	=	56.98	(77)
Southeast 0.9x	0.77	x	8.51	x	69.27	x	0.55	x	0.7	=	157.27	(77)
Southeast 0.9x	0.77	x	9.45	x	69.27	x	0.55	x	0.7	=	174.64	(77)
Southeast 0.9x	0.77	x	2.3	x	69.27	x	0.55	x	0.7	=	42.51	(77)
Southeast 0.9x	0.77	x	8.51	x	44.07	x	0.55	x	0.7	=	100.06	(77)
Southeast 0.9x	0.77	x	9.45	x	44.07	x	0.55	x	0.7	=	111.12	(77)
Southeast 0.9x	0.77	x	2.3	x	44.07	x	0.55	x	0.7	=	27.04	(77)
Southeast 0.9x	0.77	x	8.51	x	31.49	x	0.55	x	0.7	=	71.49	(77)
Southeast 0.9x	0.77	x	9.45	x	31.49	x	0.55	x	0.7	=	79.39	(77)
Southeast 0.9x	0.77	x	2.3	x	31.49	x	0.55	x	0.7	=	19.32	(77)
Southwest 0.9x	0.77	x	2.3	x	36.79		0.55	x	0.7	=	22.58	(79)
Southwest 0.9x	0.77	x	2.3	x	62.67		0.55	x	0.7	=	38.46	(79)
Southwest 0.9x	0.77	x	2.3	x	85.75		0.55	x	0.7	=	52.62	(79)
Southwest 0.9x	0.77	x	2.3	x	106.25		0.55	x	0.7	=	65.2	(79)
Southwest 0.9x	0.77	x	2.3	x	119.01		0.55	x	0.7	=	73.03	(79)
Southwest 0.9x	0.77	x	2.3	x	118.15		0.55	x	0.7	=	72.5	(79)
Southwest 0.9x	0.77	x	2.3	x	113.91		0.55	x	0.7	=	69.9	(79)
Southwest 0.9x	0.77	x	2.3	x	104.39		0.55	x	0.7	=	64.06	(79)
Southwest 0.9x	0.77	x	2.3	x	92.85		0.55	x	0.7	=	56.98	(79)
Southwest 0.9x	0.77	x	2.3	x	69.27		0.55	x	0.7	=	42.51	(79)
Southwest 0.9x	0.77	x	2.3	x	44.07		0.55	x	0.7	=	27.04	(79)
Southwest 0.9x	0.77	x	2.3	x	31.49		0.55	x	0.7	=	19.32	(79)
Northwest 0.9x	0.77	x	2.3	x	11.28	x	0.55	x	0.7	=	6.92	(81)
Northwest 0.9x	0.77	x	2.3	x	22.97	x	0.55	x	0.7	=	14.09	(81)
Northwest 0.9x	0.77	x	2.3	x	41.38	x	0.55	x	0.7	=	25.39	(81)
Northwest 0.9x	0.77	x	2.3	x	67.96	x	0.55	x	0.7	=	41.7	(81)
Northwest 0.9x	0.77	x	2.3	x	91.35	x	0.55	x	0.7	=	56.05	(81)
Northwest 0.9x	0.77	x	2.3	x	97.38	x	0.55	x	0.7	=	59.76	(81)
Northwest 0.9x	0.77	x	2.3	x	91.1	x	0.55	x	0.7	=	55.9	(81)
Northwest 0.9x	0.77	x	2.3	x	72.63	x	0.55	x	0.7	=	44.57	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	2.3	x	50.42	x	0.55	x	0.7	=	30.94	(81)
Northwest 0.9x	0.77	x	2.3	x	28.07	x	0.55	x	0.7	=	17.22	(81)
Northwest 0.9x	0.77	x	2.3	x	14.2	x	0.55	x	0.7	=	8.71	(81)
Northwest 0.9x	0.77	x	2.3	x	9.21	x	0.55	x	0.7	=	5.65	(81)

Solar gains in watts, calculated for each month

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

(83)m=	261.68	459.1	663.65	881.77	1041.94	1058.29	1010.36	887.22	738.61	516.98	315.87	222.37	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	703.5	898.72	1087.78	1280.41	1414.1	1405.08	1341.22	1225.14	1090.21	894.3	722.37	651.01	(84)
--------	-------	--------	---------	---------	--------	---------	---------	---------	---------	-------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.95	0.85	0.67	0.47	0.34	0.39	0.64	0.92	0.99	1	(86)

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

(87)m=	19.95	20.19	20.49	20.8	20.95	20.99	21	21	20.97	20.73	20.27	19.91	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.05	20.05	20.07	20.07	20.07	20.06	20.05	20.04	20.04	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.98	0.94	0.82	0.61	0.41	0.27	0.31	0.57	0.89	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	18.63	18.98	19.41	19.84	20.01	20.06	20.07	20.07	20.04	19.76	19.12	18.58	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.26

(91)

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

(92)m=	18.97	19.29	19.69	20.09	20.25	20.3	20.3	20.31	20.28	20.01	19.41	18.92	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.82	19.14	19.54	19.94	20.1	20.15	20.15	20.16	20.13	19.86	19.26	18.77	(93)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.93	0.81	0.62	0.41	0.28	0.32	0.57	0.89	0.98	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	698.51	878.22	1014.13	1037.72	870.34	581.33	373.73	393.3	624.43	791.49	709.29	647.81	(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=	1597.53	1561.3	1425.29	1185.61	899.71	583.99	373.96	393.79	638.85	991.19	1311.1	1582	(97)
--------	---------	--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	------	------

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

(98)m=	668.87	459.03	305.9	106.48	21.85	0	0	0	0	148.58	433.3	695.03	(98)
--------	--------	--------	-------	--------	-------	---	---	---	---	--------	-------	--------	------

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

2839.05

(98)

Space heating requirement in kWh/m²/year

27.56

(99)

DER WorkSheet: New dwelling design stage

8c. Space cooling requirement

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	988.88	778.48	796.69	0	0	0	0	(100)
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Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
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Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	969.67	772.23	786.3	0	0	0	0	(102)
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Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1739.88	1663.22	1528.92	0	0	0	0	(103)
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Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	554.55	662.9	552.51	0	0	0	0	
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Total = Sum(104) = 1769.96 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.7 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
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Total = Sum(104) = 0 (106)

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

(107)m=	0	0	0	0	0	96.9	115.83	96.54	0	0	0	0	
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Total = Sum(107) = 309.28 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 3 (108)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0	(201)
---	-------

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1	(202)
---	-------

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1	(204)
---	-------

Efficiency of main space heating system 1

90.4	(206)
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Efficiency of secondary/supplementary heating system, %

0	(208)
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Cooling System Energy Efficiency Ratio

5.13	(209)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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kWh/year

Space heating requirement (calculated above)

668.87	459.03	305.9	106.48	21.85	0	0	0	0	148.58	433.3	695.03
--------	--------	-------	--------	-------	---	---	---	---	--------	-------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206)

(211)

739.9	507.78	338.39	117.79	24.17	0	0	0	0	164.36	479.31	768.84
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Total (kWh/year) = Sum(211)_{1...5,10, 12} = 3140.54 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
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Total (kWh/year) = Sum(215)_{1...5,10, 12} = 0 (215)

Water heating

Output from water heater (calculated above)

213.9	188.54	198.01	176.48	170.86	150.49	144.18	160.73	162.5	184.08	194.63	208.76
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Efficiency of water heater

80.3	(216)
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DER WorkSheet: New dwelling design stage

(217)m=

87.73	87.21	86.14	83.82	81.33	80.3	80.3	80.3	80.3	84.52	87.01	87.85
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 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

243.83	216.19	229.87	210.54	210.09	187.41	179.55	200.16	202.37	217.8	223.69	237.64
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Total = Sum(219a)_{1...12} =

2559.11

 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

(221)m=

0	0	0	0	0	18.89	22.58	18.82	0	0	0	0
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Total = Sum(221)_{6...8} =

60.29

 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Space cooling fuel used

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

247.72

 (230a)

central heating pump:

30

 (230c)

Total electricity for the above, kWh/year

sum of (230a) (230g) =

277.72

 (231)

Electricity for lighting

411.09

 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	<div>0.216</div> =	<div>678.36</div> (261)
Space heating (secondary)	(215) x	<div>0.519</div> =	<div>0</div> (263)
Water heating	(219) x	<div>0.216</div> =	<div>552.77</div> (264)
Space and water heating	(261) + (262) + (263) + (264) =		<div>1231.12</div> (265)
Space cooling	(221) x	<div>0.519</div> =	<div>31.29</div> (266)
Electricity for pumps, fans and electric keep-hot	(231) x	<div>0.519</div> =	<div>144.14</div> (267)
Electricity for lighting	(232) x	<div>0.519</div> =	<div>213.36</div> (268)
Total CO2, kg/year	sum of (265) (271) =		<div>1619.91</div> (272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =		<div>15.73</div> (273)
El rating (section 14)			<div>85</div> (274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.10

Property Address: Flat 04

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Basement	59.89 (1a) x	2.7 (2a) =	161.7 (3a)
Ground floor	46.65 (1b) x	3.27 (2b) =	152.55 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	106.54 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	314.25 (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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
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)
<i>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</i>		
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)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.15 (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

	0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18
--	------	------	------	------	------	------	------	------	------	------	------	------

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) =

73.95 (23c)

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

(24a)m=	0.32	0.32	0.31	0.3	0.29	0.27	0.27	0.27	0.28	0.29	0.3	0.31	(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=	0.32	0.32	0.31	0.3	0.29	0.27	0.27	0.27	0.28	0.29	0.3	0.31	(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			8.51	$x1/[1/(1.2)+0.04] =$	9.74		(27)
Windows Type 2			2.3	$x1/[1/(1.2)+0.04] =$	2.63		(27)
Windows Type 3			8.51	$x1/[1/(1.2)+0.04] =$	9.74		(27)
Windows Type 4			5.35	$x1/[1/(1.2)+0.04] =$	6.13		(27)
Floor			59.89	x 0.1 =	5.989		(28)
Walls Type1	11.62	0	11.62	x 0.16 =	1.86		(29)
Walls Type2	34.96	24.67	10.29	x 0.16 =	1.65		(29)
Walls Type3	62.35	0	62.35	x 0.16 =	9.98		(29)
Roof Type1	15.98	0	15.98	x 0.12 =	1.92		(30)
Roof Type2	16.48	0	16.48	x 0.12 =	1.98		(30)
Total area of elements, m²			201.27				(31)

* 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) = 51.61 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 20791.96 (34)

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

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

DER WorkSheet: New dwelling design stage

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

7.67 (36)

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

Total fabric heat loss

(33) + (36) =

59.28 (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=	33.34	32.95	32.56	30.62	30.23	28.28	28.28	27.9	29.06	30.23	31.01	31.78

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	92.62	92.23	91.84	89.9	89.51	87.56	87.56	87.17	88.34	89.51	90.28	91.06
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

Average = Sum(39)₁₋₁₂ / 12 =

89.8 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=	0.87	0.87	0.86	0.84	0.84	0.82	0.82	0.82	0.83	0.84	0.85	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

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

2.79

(42)

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

100.52

(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=	110.57	106.55	102.53	98.51	94.49	90.47	90.47	94.49	98.51	102.53	106.55	110.57
--------	--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	--------	--------

Total = Sum(44)₁₋₁₂ =

1206.23 (44)

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

(45)m=	163.97	143.41	147.99	129.02	123.8	106.83	98.99	113.59	114.95	133.96	146.23	158.8
--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	-------

Total = Sum(45)₁₋₁₂ =

1581.56 (45)

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

(46)m=	24.6	21.51	22.2	19.35	18.57	16.02	14.85	17.04	17.24	20.09	21.93	23.82
--------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

DER WorkSheet: New dwelling design stage

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

0
0

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

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

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

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

(61)m=

50.96	46.03	50.96	48.58	48.15	44.61	46.1	48.15	48.58	50.96	49.32	50.96
-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------

(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=

214.93	189.44	198.95	177.6	171.95	151.44	145.09	161.74	163.53	184.92	195.55	209.76
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(62)

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

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

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

214.93	189.44	198.95	177.6	171.95	151.44	145.09	161.74	163.53	184.92	195.55	209.76
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

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

2164.91

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=

67.26	59.19	61.95	55.04	53.2	46.67	44.44	49.81	50.37	57.28	60.95	65.54
-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

(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
139.62	139.62	139.62	139.62	139.62	139.62	139.62	139.62	139.62	139.62	139.62	139.62

(66)

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

(67)m=

23.76	21.1	17.16	12.99	9.71	8.2	8.86	11.52	15.46	19.62	22.91	24.42
-------	------	-------	-------	------	-----	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

266.49	269.25	262.28	247.45	228.72	211.12	199.36	196.6	203.57	218.4	237.13	254.73
--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------

(68)

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

(69)m=

36.96	36.96	36.96	36.96	36.96	36.96	36.96	36.96	36.96	36.96	36.96	36.96
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

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

(71)m=

-111.7	-111.7	-111.7	-111.7	-111.7	-111.7	-111.7	-111.7	-111.7	-111.7	-111.7	-111.7
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

90.4	88.08	83.26	76.45	71.51	64.82	59.73	66.95	69.95	76.99	84.65	88.09
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

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

(73)m=

448.54	446.32	430.59	404.78	377.83	352.03	335.84	342.95	356.86	382.91	412.57	435.13
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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)	
Southeast 0.9x	0.77	x	8.51	x	36.79	x	0.55	x	0.7	=	83.54	(77)
Southeast 0.9x	0.77	x	8.51	x	36.79	x	0.55	x	0.7	=	83.54	(77)
Southeast 0.9x	0.77	x	5.35	x	36.79	x	0.55	x	0.7	=	52.52	(77)
Southeast 0.9x	0.77	x	8.51	x	62.67	x	0.55	x	0.7	=	142.3	(77)
Southeast 0.9x	0.77	x	8.51	x	62.67	x	0.55	x	0.7	=	142.3	(77)
Southeast 0.9x	0.77	x	5.35	x	62.67	x	0.55	x	0.7	=	89.46	(77)
Southeast 0.9x	0.77	x	8.51	x	85.75	x	0.55	x	0.7	=	194.7	(77)
Southeast 0.9x	0.77	x	8.51	x	85.75	x	0.55	x	0.7	=	194.7	(77)
Southeast 0.9x	0.77	x	5.35	x	85.75	x	0.55	x	0.7	=	122.4	(77)
Southeast 0.9x	0.77	x	8.51	x	106.25	x	0.55	x	0.7	=	241.25	(77)
Southeast 0.9x	0.77	x	8.51	x	106.25	x	0.55	x	0.7	=	241.25	(77)
Southeast 0.9x	0.77	x	5.35	x	106.25	x	0.55	x	0.7	=	151.66	(77)
Southeast 0.9x	0.77	x	8.51	x	119.01	x	0.55	x	0.7	=	270.21	(77)
Southeast 0.9x	0.77	x	8.51	x	119.01	x	0.55	x	0.7	=	270.21	(77)
Southeast 0.9x	0.77	x	5.35	x	119.01	x	0.55	x	0.7	=	169.88	(77)
Southeast 0.9x	0.77	x	8.51	x	118.15	x	0.55	x	0.7	=	268.26	(77)
Southeast 0.9x	0.77	x	8.51	x	118.15	x	0.55	x	0.7	=	268.26	(77)
Southeast 0.9x	0.77	x	5.35	x	118.15	x	0.55	x	0.7	=	168.65	(77)
Southeast 0.9x	0.77	x	8.51	x	113.91	x	0.55	x	0.7	=	258.63	(77)
Southeast 0.9x	0.77	x	8.51	x	113.91	x	0.55	x	0.7	=	258.63	(77)
Southeast 0.9x	0.77	x	5.35	x	113.91	x	0.55	x	0.7	=	162.59	(77)
Southeast 0.9x	0.77	x	8.51	x	104.39	x	0.55	x	0.7	=	237.02	(77)
Southeast 0.9x	0.77	x	8.51	x	104.39	x	0.55	x	0.7	=	237.02	(77)
Southeast 0.9x	0.77	x	5.35	x	104.39	x	0.55	x	0.7	=	149.01	(77)
Southeast 0.9x	0.77	x	8.51	x	92.85	x	0.55	x	0.7	=	210.82	(77)
Southeast 0.9x	0.77	x	8.51	x	92.85	x	0.55	x	0.7	=	210.82	(77)
Southeast 0.9x	0.77	x	5.35	x	92.85	x	0.55	x	0.7	=	132.54	(77)
Southeast 0.9x	0.77	x	8.51	x	69.27	x	0.55	x	0.7	=	157.27	(77)
Southeast 0.9x	0.77	x	8.51	x	69.27	x	0.55	x	0.7	=	157.27	(77)
Southeast 0.9x	0.77	x	5.35	x	69.27	x	0.55	x	0.7	=	98.87	(77)
Southeast 0.9x	0.77	x	8.51	x	44.07	x	0.55	x	0.7	=	100.06	(77)
Southeast 0.9x	0.77	x	8.51	x	44.07	x	0.55	x	0.7	=	100.06	(77)
Southeast 0.9x	0.77	x	5.35	x	44.07	x	0.55	x	0.7	=	62.91	(77)
Southeast 0.9x	0.77	x	8.51	x	31.49	x	0.55	x	0.7	=	71.49	(77)
Southeast 0.9x	0.77	x	8.51	x	31.49	x	0.55	x	0.7	=	71.49	(77)
Southeast 0.9x	0.77	x	5.35	x	31.49	x	0.55	x	0.7	=	44.95	(77)
Southwest 0.9x	0.77	x	2.3	x	36.79		0.55	x	0.7	=	22.58	(79)
Southwest 0.9x	0.77	x	2.3	x	62.67		0.55	x	0.7	=	38.46	(79)
Southwest 0.9x	0.77	x	2.3	x	85.75		0.55	x	0.7	=	52.62	(79)

DER WorkSheet: New dwelling design stage

Southwest0.9x	0.77	x	2.3	x	106.25	0.55	x	0.7	=	65.2	(79)
Southwest0.9x	0.77	x	2.3	x	119.01	0.55	x	0.7	=	73.03	(79)
Southwest0.9x	0.77	x	2.3	x	118.15	0.55	x	0.7	=	72.5	(79)
Southwest0.9x	0.77	x	2.3	x	113.91	0.55	x	0.7	=	69.9	(79)
Southwest0.9x	0.77	x	2.3	x	104.39	0.55	x	0.7	=	64.06	(79)
Southwest0.9x	0.77	x	2.3	x	92.85	0.55	x	0.7	=	56.98	(79)
Southwest0.9x	0.77	x	2.3	x	69.27	0.55	x	0.7	=	42.51	(79)
Southwest0.9x	0.77	x	2.3	x	44.07	0.55	x	0.7	=	27.04	(79)
Southwest0.9x	0.77	x	2.3	x	31.49	0.55	x	0.7	=	19.32	(79)

Solar gains in watts, calculated for each month

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

(83)m=	242.18	412.52	564.43	699.36	783.34	777.67	749.76	687.11	611.16	455.92	290.08	207.26	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	690.72	858.84	995.02	1104.13	1161.16	1129.7	1085.6	1030.05	968.02	838.83	702.65	642.38	(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	0.96	0.86	0.69	0.49	0.35	0.39	0.62	0.91	0.99	1	(86)

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

(87)m=	20.2	20.41	20.65	20.87	20.97	21	21	21	20.99	20.84	20.48	20.17	(87)
--------	------	-------	-------	-------	-------	----	----	----	-------	-------	-------	-------	------

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

(88)m=	20.19	20.2	20.2	20.22	20.22	20.23	20.23	20.24	20.23	20.22	20.21	20.21	(88)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.98	0.94	0.83	0.64	0.44	0.29	0.32	0.55	0.88	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	19.13	19.43	19.76	20.08	20.19	20.23	20.23	20.24	20.22	20.05	19.54	19.09	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.25 (91)

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

(92)m=	19.39	19.67	19.98	20.27	20.39	20.42	20.42	20.43	20.41	20.25	19.77	19.36	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.24	19.52	19.83	20.12	20.24	20.27	20.27	20.28	20.26	20.1	19.62	19.21	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.82	0.64	0.44	0.3	0.33	0.56	0.87	0.98	1	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	---	------

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

(95)m=	686.43	840.38	931.58	910.2	746.31	495.57	321.72	337.85	538.93	731.87	690	639.69	(95)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	-----	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1384.12	1348.36	1224.55	1008.94	764.23	496.76	321.79	337.99	544.38	849.94	1130.77	1366.88	(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=	519.08	341.37	217.97	71.09	13.34	0	0	0	0	87.84	317.35	541.03	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2109.08 (98)

Space heating requirement in kWh/m²/year

19.8 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	823.09	647.96	662.52	0	0	0	0	(100)

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.99	1	0.99	0	0	0	0	(101)
---------	---	---	---	---	---	------	---	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	813.64	645.54	658.89	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1419.79	1366.17	1302.67	0	0	0	0	(103)
---------	---	---	---	---	---	---------	---------	---------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$

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

(104)m=	0	0	0	0	0	436.43	536.16	478.97	0	0	0	0	
Total = Sum(104) =													1451.56 (104)
Cooled fraction	f C = cooled area ÷ (4) =												0.7 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104) =													0 (106)

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

(107)m=	0	0	0	0	0	76.3	93.73	83.73	0	0	0	0	
Total = Sum(107) =													253.76 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) =	2.38 (108)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system	0 (201)
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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
--	---------------------	---------

Fraction of total heating from main system 1	(204) = (202) x [1 – (203)] =	1 (204)
--	-------------------------------	---------

Efficiency of main space heating system 1	90.4 (206)
---	------------

Efficiency of secondary/supplementary heating system, %	0 (208)
---	---------

Cooling System Energy Efficiency Ratio	5.13 (209)
--	------------

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement (calculated above)	519.08	341.37	217.97	71.09	13.34	0	0	0	0	87.84	317.35	541.03	

(211)m = [(98)m x (204)] x 100 ÷ (206)													(211)
--	--	--	--	--	--	--	--	--	--	--	--	--	-------

(211)m =	574.21	377.62	241.12	78.64	14.75	0	0	0	0	97.17	351.05	598.49	
Total (kWh/year) = Sum(211) _{1...5,10...12} =													2333.06 (211)

Space heating fuel (secondary), kWh/month

= [(98)m x (201)] x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1...5,10...12} =													0 (215)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

214.93	189.44	198.95	177.6	171.95	151.44	145.09	161.74	163.53	184.92	195.55	209.76
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Efficiency of water heater

80.3 (216)

(217)m= 87.19 86.52 85.28 82.95 80.95 80.3 80.3 80.3 80.3 83.3 86.26 87.33 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

246.51	218.96	233.28	214.11	212.41	188.6	180.69	201.43	203.65	222.01	226.69	240.19
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Total = Sum(219a)_{1...12} = 2588.52 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	14.87	18.27	16.32	0	0	0	0
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Total = Sum(221)_{6...8} = 49.47 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

2333.06

Water heating fuel used

2588.52

Space cooling fuel used

49.47

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

258.78

(230a)

central heating pump:

30

(230c)

Total electricity for the above, kWh/year

sum of (230a) (230g) =

288.78

(231)

Electricity for lighting

419.57

(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 503.94 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 559.12 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1063.06 (265)
Space cooling	(221) x	0.519	= 25.67 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 149.88 (267)
Electricity for lighting	(232) x	0.519	= 217.76 (268)
Total CO2, kg/year		sum of (265) (271) =	1456.37 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	13.67 (273)
El rating (section 14)			87 (274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.10

Property Address: Flat 05

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Basement	<input type="text" value="71.92"/> (1a) x	<input type="text" value="2.5"/> (2a) =	<input type="text" value="179.81"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="71.92"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="179.81"/> (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	<input type="text" value="0"/> +	<input type="text" value="0"/> +	<input type="text" value="0"/> =	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> +	<input type="text" value="0"/> +	<input type="text" value="0"/> =	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7a)
Number of passive vents				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires				<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="0"/> ÷ (5) =	<input type="text" value="0"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		<input type="text" value="0"/> (9)
Additional infiltration	[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>		<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0		<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped		<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		<input type="text" value="3"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		<input type="text" value="0.15"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		<input type="text" value="0"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	<input type="text" value="1"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	<input type="text" value="0.15"/> (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

0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18
------	------	------	------	------	------	------	------	------	------	------	------

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) =

73.95 (23c)

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

(24a)m= 0.32 0.32 0.31 0.3 0.29 0.27 0.27 0.27 0.28 0.29 0.3 0.31 (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= 0.32 0.32 0.31 0.3 0.29 0.27 0.27 0.27 0.28 0.29 0.3 0.31 (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			17.75	$\times 1/[1/(1.2) + 0.04] =$	20.32		(27)
Windows Type 2			4.65	$\times 1/[1/(1.2) + 0.04] =$	5.32		(27)
Windows Type 3			4.65	$\times 1/[1/(1.2) + 0.04] =$	5.32		(27)
Walls Type1	68.66	27.05	41.61	$\times 0.16 =$	6.66		(29)
Walls Type2	17.76	0	17.76	$\times 0.16 =$	2.84		(29)
Total area of elements, m²			86.42				(31)

* 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) = 40.47 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 11280.49 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 12.41 (36)

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

Total fabric heat loss (33) + (36) = 52.88 (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=	19.08	18.85	18.63	17.52	17.3	16.18	16.18	15.96	16.63	17.3	17.74	18.19

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

(39)m= 71.96 71.74 71.51 70.4 70.18 69.07 69.07 68.84 69.51 70.18 70.62 71.07
Average = Sum(39)₁₋₁₂ /12= 70.34 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99		
Average = Sum(40) ₁₋₁₂ / 12 =													0.98	(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

2.29

(42)

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

if TFA ≤ 13.9, N = 1

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

88.63

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

(44)m=	97.5	93.95	90.41	86.86	83.31	79.77	79.77	83.31	86.86	90.41	93.95	97.5		
Total = Sum(44) ₁₋₁₂ =													1063.6	(44)

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

(45)m=	144.58	126.45	130.49	113.76	109.16	94.2	87.29	100.16	101.36	118.12	128.94	140.02		
Total = Sum(45) ₁₋₁₂ =													1394.54	(45)

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

(46)m=	21.69	18.97	19.57	17.06	16.37	14.13	13.09	15.02	15.2	17.72	19.34	21		(46)
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Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

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

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

DER WorkSheet: New dwelling design stage

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

(61)m=	49.68	43.24	46.07	42.84	42.46	39.34	40.65	42.46	42.84	46.07	46.33	49.68	(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=	194.27	169.7	176.56	156.6	151.62	133.53	127.94	142.62	144.19	164.19	175.27	189.71	(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=	194.27	169.7	176.56	156.6	151.62	133.53	127.94	142.62	144.19	164.19	175.27	189.71	
Output from water heater (annual) _{1 12}												1926.19	(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=	60.49	52.86	54.91	48.54	46.91	41.15	39.19	43.92	44.41	50.79	54.46	58.98	(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=	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	(66)

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

(67)m=	17.99	15.97	12.99	9.84	7.35	6.21	6.71	8.72	11.7	14.86	17.34	18.49	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.75	203.84	198.56	187.33	173.16	159.83	150.93	148.84	154.11	165.34	179.52	192.84	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	(69)
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Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	(71)
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Water heating gains (Table 5)

(72)m=	81.31	78.66	73.8	67.41	63.05	57.16	52.67	59.03	61.68	68.27	75.63	79.27	(72)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	361.42	358.85	345.73	324.96	303.94	283.58	270.68	276.96	287.87	308.85	332.87	350.98	(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.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g ₁ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	4.65	x	11.28	x	0.55	x	0.7	=	14	(75)
Northeast 0.9x	0.77	x	4.65	x	22.97	x	0.55	x	0.7	=	28.49	(75)
Northeast 0.9x	0.77	x	4.65	x	41.38	x	0.55	x	0.7	=	51.34	(75)
Northeast 0.9x	0.77	x	4.65	x	67.96	x	0.55	x	0.7	=	84.31	(75)
Northeast 0.9x	0.77	x	4.65	x	91.35	x	0.55	x	0.7	=	113.33	(75)

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Northeast 0.9x	0.77	x	4.65	x	97.38	x	0.55	x	0.7	=	120.82	(75)
Northeast 0.9x	0.77	x	4.65	x	91.1	x	0.55	x	0.7	=	113.02	(75)
Northeast 0.9x	0.77	x	4.65	x	72.63	x	0.55	x	0.7	=	90.1	(75)
Northeast 0.9x	0.77	x	4.65	x	50.42	x	0.55	x	0.7	=	62.55	(75)
Northeast 0.9x	0.77	x	4.65	x	28.07	x	0.55	x	0.7	=	34.82	(75)
Northeast 0.9x	0.77	x	4.65	x	14.2	x	0.55	x	0.7	=	17.61	(75)
Northeast 0.9x	0.77	x	4.65	x	9.21	x	0.55	x	0.7	=	11.43	(75)
Southeast 0.9x	0.77	x	17.75	x	36.79	x	0.55	x	0.7	=	174.25	(77)
Southeast 0.9x	0.77	x	17.75	x	62.67	x	0.55	x	0.7	=	296.81	(77)
Southeast 0.9x	0.77	x	17.75	x	85.75	x	0.55	x	0.7	=	406.11	(77)
Southeast 0.9x	0.77	x	17.75	x	106.25	x	0.55	x	0.7	=	503.19	(77)
Southeast 0.9x	0.77	x	17.75	x	119.01	x	0.55	x	0.7	=	563.61	(77)
Southeast 0.9x	0.77	x	17.75	x	118.15	x	0.55	x	0.7	=	559.53	(77)
Southeast 0.9x	0.77	x	17.75	x	113.91	x	0.55	x	0.7	=	539.45	(77)
Southeast 0.9x	0.77	x	17.75	x	104.39	x	0.55	x	0.7	=	494.37	(77)
Southeast 0.9x	0.77	x	17.75	x	92.85	x	0.55	x	0.7	=	439.73	(77)
Southeast 0.9x	0.77	x	17.75	x	69.27	x	0.55	x	0.7	=	328.04	(77)
Southeast 0.9x	0.77	x	17.75	x	44.07	x	0.55	x	0.7	=	208.71	(77)
Southeast 0.9x	0.77	x	17.75	x	31.49	x	0.55	x	0.7	=	149.12	(77)
Southwest 0.9x	0.77	x	4.65	x	36.79		0.55	x	0.7	=	45.65	(79)
Southwest 0.9x	0.77	x	4.65	x	62.67		0.55	x	0.7	=	77.76	(79)
Southwest 0.9x	0.77	x	4.65	x	85.75		0.55	x	0.7	=	106.39	(79)
Southwest 0.9x	0.77	x	4.65	x	106.25		0.55	x	0.7	=	131.82	(79)
Southwest 0.9x	0.77	x	4.65	x	119.01		0.55	x	0.7	=	147.65	(79)
Southwest 0.9x	0.77	x	4.65	x	118.15		0.55	x	0.7	=	146.58	(79)
Southwest 0.9x	0.77	x	4.65	x	113.91		0.55	x	0.7	=	141.32	(79)
Southwest 0.9x	0.77	x	4.65	x	104.39		0.55	x	0.7	=	129.51	(79)
Southwest 0.9x	0.77	x	4.65	x	92.85		0.55	x	0.7	=	115.2	(79)
Southwest 0.9x	0.77	x	4.65	x	69.27		0.55	x	0.7	=	85.94	(79)
Southwest 0.9x	0.77	x	4.65	x	44.07		0.55	x	0.7	=	54.68	(79)
Southwest 0.9x	0.77	x	4.65	x	31.49		0.55	x	0.7	=	39.07	(79)

Solar gains in watts, calculated for each month

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

(83)m= 233.89 403.06 563.83 719.31 824.59 826.93 793.79 713.99 617.48 448.79 281 199.62 (83)

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

(84)m= 595.31 761.91 909.56 1044.27 1128.52 1110.51 1064.48 990.95 905.35 757.64 613.87 550.6 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.99	0.97	0.9	0.75	0.57	0.4	0.29	0.32	0.52	0.84	0.97	0.99

(86)

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

(87)m= 20.18 20.44 20.71 20.91 20.98 21 21 21 20.99 20.87 20.48 20.13 (87)

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

(88)m=	20.08	20.09	20.09	20.1	20.1	20.12	20.12	20.12	20.11	20.1	20.1	20.09	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.88	0.71	0.52	0.34	0.23	0.26	0.46	0.79	0.96	0.99	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.01	19.38	19.74	20.01	20.09	20.12	20.12	20.12	20.11	19.97	19.46	18.94	(90)
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fLA = Living area ÷ (4) =	0.42	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.82	20.15	20.39	20.46	20.48	20.49	20.49	20.48	20.35	19.88	19.44	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.67	20	20.24	20.31	20.33	20.34	20.34	20.33	20.2	19.73	19.29	(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=	0.98	0.95	0.87	0.72	0.53	0.36	0.24	0.27	0.47	0.8	0.96	0.99	(94)
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Useful gains, hmGm, W = (94)m x (84)m

(95)m=	585.88	724.39	794.74	749.92	596.57	395.41	257.94	270.92	429.63	604.09	589.28	544.47	(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=	1082.64	1059.43	965.14	798.15	604.46	396.04	257.99	271.02	432.79	673.49	892.27	1072.32	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	369.59	225.15	126.77	34.72	5.87	0	0	0	0	51.64	218.16	392.72	(98)
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Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1424.61	(98)
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Space heating requirement in kWh/m²/year

19.81	(99)
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8c. Space cooling requirement

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	649.22	511.08	523.21	0	0	0	0	(100)
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Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.99	1	1	0	0	0	0	(101)
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Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	644.84	509.83	521.19	0	0	0	0	(102)
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Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1374.66	1319.4	1234.38	0	0	0	0	(103)
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Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m

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

(104)m=	0	0	0	0	0	525.47	602.32	530.61	0	0	0	0	(104)
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Total = Sum(104) =	1658.4	(104)
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Cooled fraction

f C = cooled area ÷ (4) =	0.7	(105)
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Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	(106)
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Total = Sum(104) =	0	(106)
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DER WorkSheet: New dwelling design stage

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

(107)m=	0	0	0	0	0	91.32	104.68	92.22	0	0	0	0	
Total = Sum(107) =													288.22 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 4.01 (108)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.13 (209)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
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Space heating requirement (calculated above)

369.59	225.15	126.77	34.72	5.87	0	0	0	0	51.64	218.16	392.72	
(211)m = {[(98)m × (204)] } × 100 ÷ (206) (211)												
408.84	249.05	140.24	38.41	6.49	0	0	0	0	57.12	241.32	434.42	
Total (kWh/year) = Sum(211) _{1..5,10..12} = 1575.9 (211)												

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10..12} = 0 (215)													

Water heating

Output from water heater (calculated above)

194.27	169.7	176.56	156.6	151.62	133.53	127.94	142.62	144.19	164.19	175.27	189.71	
Efficiency of water heater 80.3 (216)												
(217)m=	86.65	85.76	84.23	81.96	80.64	80.3	80.3	80.3	80.3	82.51	85.6	86.84 (217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=	224.21	197.87	209.61	191.06	188.03	166.29	159.32	177.61	179.57	199.01	204.75	218.45	
Total = Sum(219a) _{1..12} = 2315.77 (219)													

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

(221)m=	0	0	0	0	0	17.8	20.41	17.98	0	0	0	0	
Total = Sum(221) _{6..8} = 56.18 (221)													

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		1575.9
Water heating fuel used		2315.77
Space cooling fuel used		56.18

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside 148.07 (230a)

central heating pump: 30 (230c)

DER WorkSheet: New dwelling design stage

Total electricity for the above, kWh/year	sum of (230a) (230g) =	178.07	(231)
Electricity for lighting		317.63	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	340.39	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	500.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =			840.6	(265)
Space cooling	(221) x	0.519	=	29.16	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	92.42	(267)
Electricity for lighting	(232) x	0.519	=	164.85	(268)
Total CO2, kg/year		sum of (265) (271) =		1127.03	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		15.67	(273)
El rating (section 14)				87	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.10

Property Address: Flat 06

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Basement	<input type="text" value="65.1"/> (1a) x	<input type="text" value="2.5"/> (2a) =	<input type="text" value="162.74"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="65.1"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="162.74"/> (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7a)
Number of passive vents				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires				<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="0"/>	÷ (5) =	<input type="text" value="0"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			<input type="text" value="0"/> (9)
Additional infiltration		[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>			<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0			<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped			<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			<input type="text" value="3"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			<input type="text" value="0.15"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			<input type="text" value="0"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		<input type="text" value="1"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		<input type="text" value="0.15"/> (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

0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18
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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) =

73.95 (23c)

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

(24a)m= 0.32 0.32 0.31 0.3 0.29 0.27 0.27 0.27 0.28 0.29 0.3 0.31 (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= 0.32 0.32 0.31 0.3 0.29 0.27 0.27 0.27 0.28 0.29 0.3 0.31 (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			17.75	$\times 1/[1/(1.2) + 0.04] =$	20.32		(27)
Windows Type 2			4.65	$\times 1/[1/(1.2) + 0.04] =$	5.32		(27)
Windows Type 3			4.65	$\times 1/[1/(1.2) + 0.04] =$	5.32		(27)
Walls Type1	61.76	27.05	34.71	$\times 0.16 =$	5.55		(29)
Walls Type2	26.68	0	26.68	$\times 0.16 =$	4.27		(29)
Total area of elements, m²			88.44				(31)

* 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) = 40.8 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 11663.72 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 12.08 (36)

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

Total fabric heat loss (33) + (36) = 52.88 (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=	17.27	17.07	16.86	15.86	15.66	14.65	14.65	14.45	15.05	15.66	16.06	16.46

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

(39)m=	70.15	69.95	69.74	68.74	68.54	67.53	67.53	67.33	67.93	68.54	68.94	69.34
Average = Sum(39) ₁₋₁₂ /12=												68.69 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=	1.08	1.07	1.07	1.06	1.05	1.04	1.04	1.03	1.04	1.05	1.06	1.07		
Average = Sum(40) ₁₋₁₂ / 12 =													1.06	(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

2.12

(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

84.59

(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=	93.04	89.66	86.28	82.89	79.51	76.13	76.13	79.51	82.89	86.28	89.66	93.04		
Total = Sum(44) ₁₋₁₂ =													1015.03	(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=	137.98	120.68	124.53	108.57	104.17	89.9	83.3	95.59	96.73	112.73	123.05	133.63		
Total = Sum(45) ₁₋₁₂ =													1330.87	(45)

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

(46)m=	20.7	18.1	18.68	16.29	15.63	13.48	12.5	14.34	14.51	16.91	18.46	20.04		(46)
--------	------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	--	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
---	---	------

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

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

Water storage loss:

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

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

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

0

(50)

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

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

If community heating see section 4.3

Volume factor from Table 2a	0	(52)
-----------------------------	---	------

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

DER WorkSheet: New dwelling design stage

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

(61)m=	47.41	41.27	43.97	40.88	40.52	37.54	38.79	40.52	40.88	43.97	44.22	47.41	(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=	185.4	161.95	168.5	149.45	144.69	127.44	122.09	136.11	137.61	156.7	167.27	181.04	(62)
--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

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

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

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

Output from water heater

(64)m=	185.4	161.95	168.5	149.45	144.69	127.44	122.09	136.11	137.61	156.7	167.27	181.04	
Output from water heater (annual) _{1 12}												1838.24	(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=	57.73	50.44	52.4	46.32	44.77	39.28	37.4	41.91	42.38	48.47	51.97	56.29	(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=	106.08	106.08	106.08	106.08	106.08	106.08	106.08	106.08	106.08	106.08	106.08	106.08	(66)

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

(67)m=	16.55	14.7	11.95	9.05	6.76	5.71	6.17	8.02	10.76	13.67	15.95	17.01	(67)
--------	-------	------	-------	------	------	------	------	------	-------	-------	-------	-------	------

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

(68)m=	185.6	187.52	182.67	172.34	159.3	147.04	138.85	136.92	141.78	152.11	165.15	177.41	(68)
--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	33.61	33.61	33.61	33.61	33.61	33.61	33.61	33.61	33.61	33.61	33.61	33.61	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	77.6	75.06	70.43	64.33	60.17	54.55	50.26	56.33	58.86	65.15	72.18	75.65	(72)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	337.56	335.11	322.87	303.54	284.05	265.12	253.11	259.1	269.23	288.75	311.11	327.89	(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 ₁ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	4.65	x	11.28	x	0.55	x	0.7	=	14	(75)
Northeast 0.9x	0.77	x	4.65	x	22.97	x	0.55	x	0.7	=	28.49	(75)
Northeast 0.9x	0.77	x	4.65	x	41.38	x	0.55	x	0.7	=	51.34	(75)
Northeast 0.9x	0.77	x	4.65	x	67.96	x	0.55	x	0.7	=	84.31	(75)
Northeast 0.9x	0.77	x	4.65	x	91.35	x	0.55	x	0.7	=	113.33	(75)

DER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	4.65	x	97.38	x	0.55	x	0.7	=	120.82	(75)
Northeast 0.9x	0.77	x	4.65	x	91.1	x	0.55	x	0.7	=	113.02	(75)
Northeast 0.9x	0.77	x	4.65	x	72.63	x	0.55	x	0.7	=	90.1	(75)
Northeast 0.9x	0.77	x	4.65	x	50.42	x	0.55	x	0.7	=	62.55	(75)
Northeast 0.9x	0.77	x	4.65	x	28.07	x	0.55	x	0.7	=	34.82	(75)
Northeast 0.9x	0.77	x	4.65	x	14.2	x	0.55	x	0.7	=	17.61	(75)
Northeast 0.9x	0.77	x	4.65	x	9.21	x	0.55	x	0.7	=	11.43	(75)
Southwest 0.9x	0.77	x	4.65	x	36.79		0.55	x	0.7	=	45.65	(79)
Southwest 0.9x	0.77	x	4.65	x	62.67		0.55	x	0.7	=	77.76	(79)
Southwest 0.9x	0.77	x	4.65	x	85.75		0.55	x	0.7	=	106.39	(79)
Southwest 0.9x	0.77	x	4.65	x	106.25		0.55	x	0.7	=	131.82	(79)
Southwest 0.9x	0.77	x	4.65	x	119.01		0.55	x	0.7	=	147.65	(79)
Southwest 0.9x	0.77	x	4.65	x	118.15		0.55	x	0.7	=	146.58	(79)
Southwest 0.9x	0.77	x	4.65	x	113.91		0.55	x	0.7	=	141.32	(79)
Southwest 0.9x	0.77	x	4.65	x	104.39		0.55	x	0.7	=	129.51	(79)
Southwest 0.9x	0.77	x	4.65	x	92.85		0.55	x	0.7	=	115.2	(79)
Southwest 0.9x	0.77	x	4.65	x	69.27		0.55	x	0.7	=	85.94	(79)
Southwest 0.9x	0.77	x	4.65	x	44.07		0.55	x	0.7	=	54.68	(79)
Southwest 0.9x	0.77	x	4.65	x	31.49		0.55	x	0.7	=	39.07	(79)
Northwest 0.9x	0.77	x	17.75	x	11.28	x	0.55	x	0.7	=	53.43	(81)
Northwest 0.9x	0.77	x	17.75	x	22.97	x	0.55	x	0.7	=	108.77	(81)
Northwest 0.9x	0.77	x	17.75	x	41.38	x	0.55	x	0.7	=	195.96	(81)
Northwest 0.9x	0.77	x	17.75	x	67.96	x	0.55	x	0.7	=	321.82	(81)
Northwest 0.9x	0.77	x	17.75	x	91.35	x	0.55	x	0.7	=	432.6	(81)
Northwest 0.9x	0.77	x	17.75	x	97.38	x	0.55	x	0.7	=	461.19	(81)
Northwest 0.9x	0.77	x	17.75	x	91.1	x	0.55	x	0.7	=	431.44	(81)
Northwest 0.9x	0.77	x	17.75	x	72.63	x	0.55	x	0.7	=	343.95	(81)
Northwest 0.9x	0.77	x	17.75	x	50.42	x	0.55	x	0.7	=	238.78	(81)
Northwest 0.9x	0.77	x	17.75	x	28.07	x	0.55	x	0.7	=	132.92	(81)
Northwest 0.9x	0.77	x	17.75	x	14.2	x	0.55	x	0.7	=	67.23	(81)
Northwest 0.9x	0.77	x	17.75	x	9.21	x	0.55	x	0.7	=	43.64	(81)

Solar gains in watts, calculated for each month

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

(83)m= 113.08 215.01 353.69 537.95 693.57 728.59 685.78 563.56 416.53 253.68 139.52 94.13 (83)

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

(84)m= 450.64 550.12 676.56 841.5 977.63 993.71 938.89 822.66 685.76 542.43 450.63 422.02 (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	0.96	0.84	0.63	0.43	0.32	0.38	0.65	0.93	0.99	1

(86)

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

(87)m= 19.94 20.15 20.47 20.81 20.97 21 21 21 20.97 20.7 20.25 19.91 (87)

DER WorkSheet: New dwelling design stage

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

(88)m=	20.02	20.02	20.02	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.03	20.03	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.95	0.8	0.57	0.37	0.25	0.3	0.58	0.91	0.99	1	(89)
--------	------	------	------	-----	------	------	------	-----	------	------	------	---	------

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

(90)m=	18.62	18.92	19.37	19.84	20.01	20.05	20.05	20.05	20.03	19.71	19.07	18.58	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

$$fLA = \text{Living area} \div (4) = 0.42 \quad (91)$$

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

(92)m=	19.18	19.44	19.84	20.25	20.41	20.45	20.45	20.45	20.43	20.13	19.57	19.14	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.03	19.29	19.69	20.1	20.26	20.3	20.3	20.3	20.28	19.98	19.42	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=	0.99	0.98	0.94	0.8	0.58	0.39	0.27	0.32	0.59	0.91	0.98	0.99	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(95)m=	447.49	539.79	635.78	676.28	571.43	383.6	249.91	262.48	407.75	491.23	443.48	419.86	(95)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1033.17	1006.33	919.65	770.02	586.96	384.93	250.05	262.83	419.5	642.57	849.41	1025.56	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	-------	--------	--------	---------	------

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

(98)m=	435.75	313.51	211.2	67.49	11.56	0	0	0	0	112.6	292.27	450.64	(98)
--------	--------	--------	-------	-------	-------	---	---	---	---	-------	--------	--------	------

$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} = 1895.02 \quad (98)$$

Space heating requirement in kWh/m²/year

$$29.11 \quad (99)$$

8c. Space cooling requirement

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

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

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	634.77	499.71	511.69	0	0	0	0	(100)
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Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
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Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	626.44	496.92	506.09	0	0	0	0	(102)
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Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1232.17	1166.77	1031.74	0	0	0	0	(103)
---------	---	---	---	---	---	---------	---------	---------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$

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

(104)m=	0	0	0	0	0	436.12	498.37	391.08	0	0	0	0	(104)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

$$\text{Total} = \text{Sum}(104) = 1325.58 \quad (104)$$

Cooled fraction

$$fC = \text{cooled area} \div (4) = 0.7 \quad (105)$$

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	(106)
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$$\text{Total} = \text{Sum}(104) = 0 \quad (106)$$

DER WorkSheet: New dwelling design stage

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

(107)m=	0	0	0	0	0	76.21	87.08	68.34	0	0	0	0	
Total = Sum(107) =													231.63 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 3.56 (108)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.13 (209)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
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Space heating requirement (calculated above)

435.75	313.51	211.2	67.49	11.56	0	0	0	0	112.6	292.27	450.64	
(211)m = {[(98)m × (204)] } × 100 ÷ (206) (211)												

482.02	346.81	233.63	74.66	12.79	0	0	0	0	124.55	323.31	498.5	
Total (kWh/year) = Sum(211) _{1..5,10..12} = 2096.26 (211)												

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10..12} = 0 (215)													

Water heating

Output from water heater (calculated above)

185.4	161.95	168.5	149.45	144.69	127.44	122.09	136.11	137.61	156.7	167.27	181.04	
Efficiency of water heater 80.3 (216)												

(217)m=	87.13	86.69	85.62	83.19	80.97	80.3	80.3	80.3	80.3	84.23	86.44	87.25	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=	212.78	186.82	196.79	179.64	178.7	158.7	152.05	169.5	171.37	186.02	193.5	207.49	
Total = Sum(219a) _{1..12} = 2193.38 (219)													

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

(221)m=	0	0	0	0	0	14.86	16.98	13.32	0	0	0	0	
Total = Sum(221) _{6..8} = 45.15 (221)													

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1	2096.26	
Water heating fuel used	2193.38	
Space cooling fuel used	45.15	

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside 134.02 (230a)

central heating pump: 30 (230c)

DER WorkSheet: New dwelling design stage

Total electricity for the above, kWh/year	sum of (230a) (230g) =	164.02	(231)
Electricity for lighting		292.21	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	452.79	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	473.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =			926.56	(265)
Space cooling	(221) x	0.519	=	23.43	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	85.13	(267)
Electricity for lighting	(232) x	0.519	=	151.66	(268)
Total CO2, kg/year		sum of (265) (271) =		1186.78	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		18.23	(273)
El rating (section 14)				86	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.10

Property Address: Flat 07

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Basement	<input type="text" value="71.92"/> (1a) x	<input type="text" value="2.5"/> (2a) =	<input type="text" value="179.81"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="71.92"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="179.81"/> (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7a)
Number of passive vents				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires				<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="0"/>	÷ (5) =	<input type="text" value="0"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			<input type="text" value="0"/> (9)
Additional infiltration		[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>			<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0			<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped			<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			<input type="text" value="3"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			<input type="text" value="0.15"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			<input type="text" value="0"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		<input type="text" value="1"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		<input type="text" value="0.15"/> (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

0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18
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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) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

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

73.95 (23c)

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

(24a)m= 0.32 0.32 0.31 0.3 0.29 0.27 0.27 0.27 0.28 0.29 0.3 0.31 (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= 0.32 0.32 0.31 0.3 0.29 0.27 0.27 0.27 0.28 0.29 0.3 0.31 (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			17.75	$\times 1/[1/(1.2) + 0.04] =$	20.32		(27)
Windows Type 2			4.65	$\times 1/[1/(1.2) + 0.04] =$	5.32		(27)
Windows Type 3			4.65	$\times 1/[1/(1.2) + 0.04] =$	5.32		(27)
Walls Type1	68.66	27.05	41.61	$\times 0.16 =$	6.66		(29)
Walls Type2	17.76	0	17.76	$\times 0.16 =$	2.84		(29)
Total area of elements, m²			86.42				(31)

* 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) = 40.47 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 11280.49 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 12.41 (36)

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

Total fabric heat loss (33) + (36) = 52.88 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	19.08	18.85	18.63	17.52	17.3	16.18	16.18	15.96	16.63	17.3	17.74	18.19

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

(39)m= 71.96 71.74 71.51 70.4 70.18 69.07 69.07 68.84 69.51 70.18 70.62 71.07
Average = Sum(39)₁₋₁₂ /12= 70.34 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99		
Average = Sum(40) ₁₋₁₂ / 12 =													0.98	(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

2.29

(42)

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

if TFA ≤ 13.9, N = 1

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

88.63

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

(44)m=	97.5	93.95	90.41	86.86	83.31	79.77	79.77	83.31	86.86	90.41	93.95	97.5		
Total = Sum(44) ₁₋₁₂ =													1063.6	(44)

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

(45)m=	144.58	126.45	130.49	113.76	109.16	94.2	87.29	100.16	101.36	118.12	128.94	140.02		
Total = Sum(45) ₁₋₁₂ =													1394.54	(45)

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

(46)m=	21.69	18.97	19.57	17.06	16.37	14.13	13.09	15.02	15.2	17.72	19.34	21		(46)
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Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0

(54)

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

0

(55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(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=	0	0	0	0	0	0	0	0	0	0	0	0		(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 x (41)m

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

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
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DER WorkSheet: New dwelling design stage

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

(61)m=	49.68	43.24	46.07	42.84	42.46	39.34	40.65	42.46	42.84	46.07	46.33	49.68	(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=	194.27	169.7	176.56	156.6	151.62	133.53	127.94	142.62	144.19	164.19	175.27	189.71	(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=	194.27	169.7	176.56	156.6	151.62	133.53	127.94	142.62	144.19	164.19	175.27	189.71	
Output from water heater (annual) _{1 12}												1926.19	(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=	60.49	52.86	54.91	48.54	46.91	41.15	39.19	43.92	44.41	50.79	54.46	58.98	(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=	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	(66)

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

(67)m=	17.99	15.97	12.99	9.84	7.35	6.21	6.71	8.72	11.7	14.86	17.34	18.49	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.75	203.84	198.56	187.33	173.16	159.83	150.93	148.84	154.11	165.34	179.52	192.84	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	(69)
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Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	(71)
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Water heating gains (Table 5)

(72)m=	81.31	78.66	73.8	67.41	63.05	57.16	52.67	59.03	61.68	68.27	75.63	79.27	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	361.42	358.85	345.73	324.96	303.94	283.58	270.68	276.96	287.87	308.85	332.87	350.98	(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.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g ₁ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	4.65	x	11.28	x	0.55	x	0.7	=	14	(75)
Northeast 0.9x	0.77	x	4.65	x	22.97	x	0.55	x	0.7	=	28.49	(75)
Northeast 0.9x	0.77	x	4.65	x	41.38	x	0.55	x	0.7	=	51.34	(75)
Northeast 0.9x	0.77	x	4.65	x	67.96	x	0.55	x	0.7	=	84.31	(75)
Northeast 0.9x	0.77	x	4.65	x	91.35	x	0.55	x	0.7	=	113.33	(75)

DER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	4.65	x	97.38	x	0.55	x	0.7	=	120.82	(75)
Northeast 0.9x	0.77	x	4.65	x	91.1	x	0.55	x	0.7	=	113.02	(75)
Northeast 0.9x	0.77	x	4.65	x	72.63	x	0.55	x	0.7	=	90.1	(75)
Northeast 0.9x	0.77	x	4.65	x	50.42	x	0.55	x	0.7	=	62.55	(75)
Northeast 0.9x	0.77	x	4.65	x	28.07	x	0.55	x	0.7	=	34.82	(75)
Northeast 0.9x	0.77	x	4.65	x	14.2	x	0.55	x	0.7	=	17.61	(75)
Northeast 0.9x	0.77	x	4.65	x	9.21	x	0.55	x	0.7	=	11.43	(75)
Southeast 0.9x	0.77	x	17.75	x	36.79	x	0.55	x	0.7	=	174.25	(77)
Southeast 0.9x	0.77	x	17.75	x	62.67	x	0.55	x	0.7	=	296.81	(77)
Southeast 0.9x	0.77	x	17.75	x	85.75	x	0.55	x	0.7	=	406.11	(77)
Southeast 0.9x	0.77	x	17.75	x	106.25	x	0.55	x	0.7	=	503.19	(77)
Southeast 0.9x	0.77	x	17.75	x	119.01	x	0.55	x	0.7	=	563.61	(77)
Southeast 0.9x	0.77	x	17.75	x	118.15	x	0.55	x	0.7	=	559.53	(77)
Southeast 0.9x	0.77	x	17.75	x	113.91	x	0.55	x	0.7	=	539.45	(77)
Southeast 0.9x	0.77	x	17.75	x	104.39	x	0.55	x	0.7	=	494.37	(77)
Southeast 0.9x	0.77	x	17.75	x	92.85	x	0.55	x	0.7	=	439.73	(77)
Southeast 0.9x	0.77	x	17.75	x	69.27	x	0.55	x	0.7	=	328.04	(77)
Southeast 0.9x	0.77	x	17.75	x	44.07	x	0.55	x	0.7	=	208.71	(77)
Southeast 0.9x	0.77	x	17.75	x	31.49	x	0.55	x	0.7	=	149.12	(77)
Southwest 0.9x	0.77	x	4.65	x	36.79		0.55	x	0.7	=	45.65	(79)
Southwest 0.9x	0.77	x	4.65	x	62.67		0.55	x	0.7	=	77.76	(79)
Southwest 0.9x	0.77	x	4.65	x	85.75		0.55	x	0.7	=	106.39	(79)
Southwest 0.9x	0.77	x	4.65	x	106.25		0.55	x	0.7	=	131.82	(79)
Southwest 0.9x	0.77	x	4.65	x	119.01		0.55	x	0.7	=	147.65	(79)
Southwest 0.9x	0.77	x	4.65	x	118.15		0.55	x	0.7	=	146.58	(79)
Southwest 0.9x	0.77	x	4.65	x	113.91		0.55	x	0.7	=	141.32	(79)
Southwest 0.9x	0.77	x	4.65	x	104.39		0.55	x	0.7	=	129.51	(79)
Southwest 0.9x	0.77	x	4.65	x	92.85		0.55	x	0.7	=	115.2	(79)
Southwest 0.9x	0.77	x	4.65	x	69.27		0.55	x	0.7	=	85.94	(79)
Southwest 0.9x	0.77	x	4.65	x	44.07		0.55	x	0.7	=	54.68	(79)
Southwest 0.9x	0.77	x	4.65	x	31.49		0.55	x	0.7	=	39.07	(79)

Solar gains in watts, calculated for each month

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

(83)m= 233.89 403.06 563.83 719.31 824.59 826.93 793.79 713.99 617.48 448.79 281 199.62 (83)

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

(84)m= 595.31 761.91 909.56 1044.27 1128.52 1110.51 1064.48 990.95 905.35 757.64 613.87 550.6 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.99	0.97	0.9	0.75	0.57	0.4	0.29	0.32	0.52	0.84	0.97	0.99

(86)

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

(87)m= 20.18 20.44 20.71 20.91 20.98 21 21 21 20.99 20.87 20.48 20.13 (87)

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

(88)m=	20.08	20.09	20.09	20.1	20.1	20.12	20.12	20.12	20.11	20.1	20.1	20.09	(88)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	------	-------	------

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

(89)m=	0.99	0.96	0.88	0.71	0.52	0.34	0.23	0.26	0.46	0.79	0.96	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	19.01	19.38	19.74	20.01	20.09	20.12	20.12	20.12	20.11	19.97	19.46	18.94	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.42	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.82	20.15	20.39	20.46	20.48	20.49	20.49	20.48	20.35	19.88	19.44	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.67	20	20.24	20.31	20.33	20.34	20.34	20.33	20.2	19.73	19.29	(93)
--------	-------	-------	----	-------	-------	-------	-------	-------	-------	------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.95	0.87	0.72	0.53	0.36	0.24	0.27	0.47	0.8	0.96	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	-----	------	------	------

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

(95)m=	585.88	724.39	794.74	749.92	596.57	395.41	257.94	270.92	429.63	604.09	589.28	544.47	(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=	1082.64	1059.43	965.14	798.15	604.46	396.04	257.99	271.02	432.79	673.49	892.27	1072.32	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	369.59	225.15	126.77	34.72	5.87	0	0	0	0	51.64	218.16	392.72	(98)
--------	--------	--------	--------	-------	------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1424.61	(98)
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Space heating requirement in kWh/m²/year

19.81	(99)
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8c. Space cooling requirement

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

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

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	649.22	511.08	523.21	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.99	1	1	0	0	0	0	(101)
---------	---	---	---	---	---	------	---	---	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	644.84	509.83	521.19	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1374.66	1319.4	1234.38	0	0	0	0	(103)
---------	---	---	---	---	---	---------	--------	---------	---	---	---	---	-------

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

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

(104)m=	0	0	0	0	0	525.47	602.32	530.61	0	0	0	0	(104)
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Total = Sum(104) =	1658.4	(104)
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Cooled fraction

f C = cooled area ÷ (4) =	0.7	(105)
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Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	(106)
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Total = Sum(104) =	0	(106)
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Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	92.05	105.52	92.96	0	0	0	0		
Total = Sum(107) =													290.53	(107)
Space cooling requirement in kWh/m ² /year													4.04	(108)
(107) ÷ (4) =														

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.13	(209)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)													
369.59	225.15	126.77	34.72	5.87	0	0	0	0	51.64	218.16	392.72		
211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
408.84	249.05	140.24	38.41	6.49	0	0	0	0	57.12	241.32	434.42		
Total (kWh/year) =Sum(211) _{1...5,10.. 12} =												1575.9	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215) _{1...5,10...12} =												0	(215)

Water heating

Output from water heater (calculated above)													
194.27	169.7	176.56	156.6	151.62	133.53	127.94	142.62	144.19	164.19	175.27	189.71		
Efficiency of water heater												80.3	(216)
(217)m=	86.65	85.76	84.23	81.96	80.64	80.3	80.3	80.3	80.3	82.51	85.6	86.84	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	224.21	197.87	209.61	191.06	188.03	166.29	159.32	177.61	179.57	199.01	204.75	218.45	
Total = Sum(219a) _{1...12} =												2315.77	(219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)													
(221)m=	0	0	0	0	0	17.94	20.57	18.12	0	0	0	0	
Total = Sum(221) _{6..8} =												56.63	(221)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1	1575.9	
Water heating fuel used	2315.77	
Space cooling fuel used	56.63	
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	148.07	(230a)
central heating pump:	30	(230c)

DER WorkSheet: New dwelling design stage

Total electricity for the above, kWh/year	sum of (230a) (230g) =	178.07	(231)
Electricity for lighting		317.63	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	340.39	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	500.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =			840.6	(265)
Space cooling	(221) x	0.519	=	29.39	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	92.42	(267)
Electricity for lighting	(232) x	0.519	=	164.85	(268)
Total CO2, kg/year		sum of (265) (271) =		1127.26	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		15.67	(273)
El rating (section 14)				87	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.10

Property Address: Flat 08

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Basement	<input type="text" value="65.1"/> (1a) x	<input type="text" value="2.5"/> (2a) =	<input type="text" value="162.74"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="65.1"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="162.74"/> (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7a)
Number of passive vents				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires				<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="0"/>	÷ (5) =	<input type="text" value="0"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			<input type="text" value="0"/> (9)
Additional infiltration		[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>			<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0			<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped			<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			<input type="text" value="3"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			<input type="text" value="0.15"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			<input type="text" value="0"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		<input type="text" value="1"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		<input type="text" value="0.15"/> (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

0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18
------	------	------	------	------	------	------	------	------	------	------	------

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) =

73.95 (23c)

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

(24a)m= 0.32 0.32 0.31 0.3 0.29 0.27 0.27 0.27 0.28 0.29 0.3 0.31 (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= 0.32 0.32 0.31 0.3 0.29 0.27 0.27 0.27 0.28 0.29 0.3 0.31 (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			17.75	$x1/[1/(1.2)+0.04] =$	20.32		(27)
Windows Type 2			4.65	$x1/[1/(1.2)+0.04] =$	5.32		(27)
Windows Type 3			4.65	$x1/[1/(1.2)+0.04] =$	5.32		(27)
Walls Type1	61.76	27.05	34.71	x 0.16 =	5.55		(29)
Walls Type2	26.68	0	26.68	x 0.16 =	4.27		(29)
Roof	64.78	0	64.78	x 0.12 =	7.77		(30)
Total area of elements, m²			153.22				(31)

* 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) = 48.57 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 12246.78 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 12.25 (36)

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

Total fabric heat loss (33) + (36) = 60.82 (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=	17.27	17.07	16.86	15.86	15.66	14.65	14.65	14.45	15.05	15.66	16.06	16.46

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

(39)m=	78.09	77.89	77.68	76.68	76.48	75.47	75.47	75.27	75.87	76.48	76.88	77.28
Average = Sum(39) ₁₋₁₂ /12=												76.63 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=	1.2	1.2	1.19	1.18	1.17	1.16	1.16	1.16	1.17	1.17	1.18	1.19		
Average = Sum(40) ₁₋₁₂ / 12=													1.18	(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

2.12

(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

84.59

(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=	93.04	89.66	86.28	82.89	79.51	76.13	76.13	79.51	82.89	86.28	89.66	93.04		
Total = Sum(44) ₁₋₁₂ =													1015.03	(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=	137.98	120.68	124.53	108.57	104.17	89.9	83.3	95.59	96.73	112.73	123.05	133.63		
Total = Sum(45) ₁₋₁₂ =													1330.87	(45)

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

(46)m=	20.7	18.1	18.68	16.29	15.63	13.48	12.5	14.34	14.51	16.91	18.46	20.04		(46)
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Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

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

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

DER WorkSheet: New dwelling design stage

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

(61)m=	47.41	41.27	43.97	40.88	40.52	37.54	38.79	40.52	40.88	43.97	44.22	47.41	(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=	185.4	161.95	168.5	149.45	144.69	127.44	122.09	136.11	137.61	156.7	167.27	181.04	(62)
--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

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

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

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

Output from water heater

(64)m=	185.4	161.95	168.5	149.45	144.69	127.44	122.09	136.11	137.61	156.7	167.27	181.04	
Output from water heater (annual) _{1 12}												1838.24	(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=	57.73	50.44	52.4	46.32	44.77	39.28	37.4	41.91	42.38	48.47	51.97	56.29	(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=	106.08	106.08	106.08	106.08	106.08	106.08	106.08	106.08	106.08	106.08	106.08	106.08	(66)

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

(67)m=	16.55	14.7	11.95	9.05	6.76	5.71	6.17	8.02	10.76	13.67	15.95	17.01	(67)
--------	-------	------	-------	------	------	------	------	------	-------	-------	-------	-------	------

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

(68)m=	185.6	187.52	182.67	172.34	159.3	147.04	138.85	136.92	141.78	152.11	165.15	177.41	(68)
--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	33.61	33.61	33.61	33.61	33.61	33.61	33.61	33.61	33.61	33.61	33.61	33.61	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	-84.86	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	77.6	75.06	70.43	64.33	60.17	54.55	50.26	56.33	58.86	65.15	72.18	75.65	(72)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	337.56	335.11	322.87	303.54	284.05	265.12	253.11	259.1	269.23	288.75	311.11	327.89	(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 ₁ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	4.65	x	11.28	x	0.55	x	0.7	=	14	(75)
Northeast 0.9x	0.77	x	4.65	x	22.97	x	0.55	x	0.7	=	28.49	(75)
Northeast 0.9x	0.77	x	4.65	x	41.38	x	0.55	x	0.7	=	51.34	(75)
Northeast 0.9x	0.77	x	4.65	x	67.96	x	0.55	x	0.7	=	84.31	(75)
Northeast 0.9x	0.77	x	4.65	x	91.35	x	0.55	x	0.7	=	113.33	(75)

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Northeast 0.9x	0.77	x	4.65	x	97.38	x	0.55	x	0.7	=	120.82	(75)
Northeast 0.9x	0.77	x	4.65	x	91.1	x	0.55	x	0.7	=	113.02	(75)
Northeast 0.9x	0.77	x	4.65	x	72.63	x	0.55	x	0.7	=	90.1	(75)
Northeast 0.9x	0.77	x	4.65	x	50.42	x	0.55	x	0.7	=	62.55	(75)
Northeast 0.9x	0.77	x	4.65	x	28.07	x	0.55	x	0.7	=	34.82	(75)
Northeast 0.9x	0.77	x	4.65	x	14.2	x	0.55	x	0.7	=	17.61	(75)
Northeast 0.9x	0.77	x	4.65	x	9.21	x	0.55	x	0.7	=	11.43	(75)
Southwest 0.9x	0.77	x	4.65	x	36.79		0.55	x	0.7	=	45.65	(79)
Southwest 0.9x	0.77	x	4.65	x	62.67		0.55	x	0.7	=	77.76	(79)
Southwest 0.9x	0.77	x	4.65	x	85.75		0.55	x	0.7	=	106.39	(79)
Southwest 0.9x	0.77	x	4.65	x	106.25		0.55	x	0.7	=	131.82	(79)
Southwest 0.9x	0.77	x	4.65	x	119.01		0.55	x	0.7	=	147.65	(79)
Southwest 0.9x	0.77	x	4.65	x	118.15		0.55	x	0.7	=	146.58	(79)
Southwest 0.9x	0.77	x	4.65	x	113.91		0.55	x	0.7	=	141.32	(79)
Southwest 0.9x	0.77	x	4.65	x	104.39		0.55	x	0.7	=	129.51	(79)
Southwest 0.9x	0.77	x	4.65	x	92.85		0.55	x	0.7	=	115.2	(79)
Southwest 0.9x	0.77	x	4.65	x	69.27		0.55	x	0.7	=	85.94	(79)
Southwest 0.9x	0.77	x	4.65	x	44.07		0.55	x	0.7	=	54.68	(79)
Southwest 0.9x	0.77	x	4.65	x	31.49		0.55	x	0.7	=	39.07	(79)
Northwest 0.9x	0.77	x	17.75	x	11.28	x	0.55	x	0.7	=	53.43	(81)
Northwest 0.9x	0.77	x	17.75	x	22.97	x	0.55	x	0.7	=	108.77	(81)
Northwest 0.9x	0.77	x	17.75	x	41.38	x	0.55	x	0.7	=	195.96	(81)
Northwest 0.9x	0.77	x	17.75	x	67.96	x	0.55	x	0.7	=	321.82	(81)
Northwest 0.9x	0.77	x	17.75	x	91.35	x	0.55	x	0.7	=	432.6	(81)
Northwest 0.9x	0.77	x	17.75	x	97.38	x	0.55	x	0.7	=	461.19	(81)
Northwest 0.9x	0.77	x	17.75	x	91.1	x	0.55	x	0.7	=	431.44	(81)
Northwest 0.9x	0.77	x	17.75	x	72.63	x	0.55	x	0.7	=	343.95	(81)
Northwest 0.9x	0.77	x	17.75	x	50.42	x	0.55	x	0.7	=	238.78	(81)
Northwest 0.9x	0.77	x	17.75	x	28.07	x	0.55	x	0.7	=	132.92	(81)
Northwest 0.9x	0.77	x	17.75	x	14.2	x	0.55	x	0.7	=	67.23	(81)
Northwest 0.9x	0.77	x	17.75	x	9.21	x	0.55	x	0.7	=	43.64	(81)

Solar gains in watts, calculated for each month

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

(83)m= 113.08 215.01 353.69 537.95 693.57 728.59 685.78 563.56 416.53 253.68 139.52 94.13 (83)

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

(84)m= 450.64 550.12 676.56 841.5 977.63 993.71 938.89 822.66 685.76 542.43 450.63 422.02 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.42	0.7	0.95	0.99	1

(86)

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

(87)m= 19.78 19.99 20.32 20.72 20.93 20.99 21 21 20.94 20.6 20.11 19.74 (87)

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

(88)m=	19.92	19.92	19.93	19.94	19.94	19.95	19.95	19.96	19.95	19.94	19.94	19.93	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.99	0.95	0.83	0.62	0.4	0.27	0.32	0.62	0.92	0.99	1	(89)
--------	------	------	------	------	------	-----	------	------	------	------	------	---	------

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

(90)m=	18.31	18.61	19.09	19.63	19.88	19.95	19.95	19.95	19.91	19.49	18.8	18.26	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

fLA = Living area ÷ (4) =	0.42	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.93	19.19	19.61	20.09	20.33	20.39	20.39	20.39	20.34	19.96	19.35	18.89	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.78	19.04	19.46	19.94	20.18	20.24	20.24	20.24	20.19	19.81	19.2	18.74	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.83	0.63	0.42	0.29	0.35	0.64	0.92	0.99	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	447.53	540.59	641.27	701.74	616.8	421.96	274.63	288.37	438.95	498.87	443.97	419.84	(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=	1130.52	1101.34	1006.95	846.68	648.22	425.51	275.05	289.38	462.4	704.19	930.38	1123.5	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

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

(98)m=	508.15	376.83	272.07	104.36	23.37	0	0	0	0	152.75	350.21	523.52	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												2311.26	(98)

Space heating requirement in kWh/m²/year

35.5	(99)
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8c. Space cooling requirement

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

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

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	709.4	558.47	572.03	0	0	0	0	(100)
---------	---	---	---	---	---	-------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.97	0.99	0.98	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	689.57	551.03	558.31	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1232.17	1166.77	1031.74	0	0	0	0	(103)
---------	---	---	---	---	---	---------	---------	---------	---	---	---	---	-------

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

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

(104)m=	0	0	0	0	0	390.67	458.11	352.23	0	0	0	0	
Total = Sum(104) =												1201.01	(104)

Cooled fraction	f C = cooled area ÷ (4) =	0.7	(105)
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Intermittency factor (Table 10b)

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

Total = Sum(104)	=	0	(106)
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Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	68.26	80.05	61.55	0	0	0	0	
Total = Sum(107) =													209.86 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 3.22 (108)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.13 (209)

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

Space heating requirement (calculated above)

508.15	376.83	272.07	104.36	23.37	0	0	0	0	152.75	350.21	523.52	
(211)m = {[(98)m × (204)] } × 100 ÷ (206) 562.11 416.84 300.96 115.44 25.85 0 0 0 0 168.98 387.4 579.12 (211)												
Total (kWh/year) = Sum(211) _{1..5,10..12} = 2556.7 (211)												

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10..12} = 0 (215)													

Water heating

Output from water heater (calculated above)

185.4	161.95	168.5	149.45	144.69	127.44	122.09	136.11	137.61	156.7	167.27	181.04	
Efficiency of water heater 80.3 (216)												
(217)m=	87.46	87.11	86.25	84.17	81.57	80.3	80.3	80.3	80.3	84.99	86.87	87.57 (217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=	211.98	185.92	195.36	177.56	177.39	158.7	152.05	169.5	171.37	184.38	192.56	206.74	
Total = Sum(219a) _{1..12} = 2183.5 (219)													

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

(221)m=	0	0	0	0	0	13.31	15.6	12	0	0	0	0	
Total = Sum(221) _{6..8} = 40.91 (221)													

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1	2556.7	
Water heating fuel used	2183.5	
Space cooling fuel used	40.91	

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside 134.02 (230a)

central heating pump: 30 (230c)

DER WorkSheet: New dwelling design stage

Total electricity for the above, kWh/year	sum of (230a) (230g) =	164.02	(231)
Electricity for lighting		292.21	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	552.25	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	471.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1023.88	(265)
Space cooling	(221) x	0.519	=	21.23	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	85.13	(267)
Electricity for lighting	(232) x	0.519	=	151.66	(268)
Total CO2, kg/year		sum of (265) (271) =		1281.9	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		19.69	(273)
El rating (section 14)				84	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell
Software Name: Stroma FSAP 2012

Stroma Number: STRO016363
Software Version: Version: 1.0.4.10

Property Address: Flat 09

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Basement	<input type="text" value="88.5"/> (1a)	<input type="text" value="2.5"/> (2a)	<input type="text" value="221.25"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="88.5"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="221.25"/> (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7a)
Number of passive vents				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires				<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="0"/>	÷ (5) =	<input type="text" value="0"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			<input type="text" value="0"/> (9)
Additional infiltration		[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>			<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0			<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped			<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			<input type="text" value="3"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			<input type="text" value="0.15"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			<input type="text" value="0"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		<input type="text" value="1"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		<input type="text" value="0.15"/> (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

0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18
------	------	------	------	------	------	------	------	------	------	------	------

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) =

73.95 (23c)

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

(24a)m= 0.32 0.32 0.31 0.3 0.29 0.27 0.27 0.27 0.28 0.29 0.3 0.31 (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= 0.32 0.32 0.31 0.3 0.29 0.27 0.27 0.27 0.28 0.29 0.3 0.31 (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			17.75	$x1/[1/(1.2)+0.04] =$	20.32		(27)
Windows Type 2			4.65	$x1/[1/(1.2)+0.04] =$	5.32		(27)
Windows Type 3			4.65	$x1/[1/(1.2)+0.04] =$	5.32		(27)
Windows Type 4			11.88	$x1/[1/(1.2)+0.04] =$	13.6		(27)
Floor			16.167	x 0.1 =	1.6167		(28)
Walls Type1	76.33	38.93	37.4	x 0.16 =	5.98		(29)
Walls Type2	23.64	0	23.64	x 0.16 =	3.78		(29)
Roof	88.5	0	88.5	x 0.12 =	10.62		(30)
Total area of elements, m²			204.64				(31)

* 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) = 66.58 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13606.43 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 15.82 (36)

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

Total fabric heat loss (33) + (36) = 82.4 (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=	23.47	23.2	22.93	21.56	21.28	19.91	19.91	19.64	20.46	21.28	21.83	22.38

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

(39)m= 105.88 105.6 105.33 103.96 103.69 102.32 102.32 102.04 102.86 103.69 104.23 104.78 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=	1.2	1.19	1.19	1.17	1.17	1.16	1.16	1.15	1.16	1.17	1.18	1.18		
Average = Sum(40) ₁₋₁₂ / 12 =													1.17	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.6

(42)

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

if TFA ≤ 13.9, N = 1

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

96.06

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more 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=	105.67	101.82	97.98	94.14	90.3	86.45	86.45	90.3	94.14	97.98	101.82	105.67		
Total = Sum(44) ₁₋₁₂ =													1152.72	(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=	156.7	137.05	141.42	123.3	118.31	102.09	94.6	108.56	109.85	128.02	139.75	151.76		
Total = Sum(45) ₁₋₁₂ =													1511.4	(45)

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

(46)m=	23.5	20.56	21.21	18.49	17.75	15.31	14.19	16.28	16.48	19.2	20.96	22.76		(46)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	--	------

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

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

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

DER WorkSheet: New dwelling design stage

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

(61)m=	50.96	46.03	49.93	46.42	46.01	42.63	44.06	46.01	46.42	49.93	49.32	50.96	(61)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(62)m=	207.66	183.08	191.35	169.72	164.32	144.72	138.66	154.57	156.28	177.95	189.06	202.71	(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=	207.66	183.08	191.35	169.72	164.32	144.72	138.66	154.57	156.28	177.95	189.06	202.71	
Output from water heater (annual) _{1 12}												2080.08	(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=	64.84	57.08	59.51	52.6	50.84	44.6	42.47	47.6	48.13	55.05	58.79	63.2	(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=	130.23	130.23	130.23	130.23	130.23	130.23	130.23	130.23	130.23	130.23	130.23	130.23	(66)

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

(67)m=	21.07	18.71	15.22	11.52	8.61	7.27	7.86	10.21	13.7	17.4	20.31	21.65	(67)
--------	-------	-------	-------	-------	------	------	------	-------	------	------	-------	-------	------

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

(68)m=	236.29	238.74	232.56	219.41	202.81	187.2	176.77	174.32	180.5	193.65	210.26	225.87	(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=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-104.19	-104.19	-104.19	-104.19	-104.19	-104.19	-104.19	-104.19	-104.19	-104.19	-104.19	-104.19	(71)
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

Water heating gains (Table 5)

(72)m=	87.15	84.93	79.98	73.06	68.33	61.95	57.08	63.98	66.85	73.99	81.66	84.94	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	409.58	407.46	392.83	369.06	344.82	321.49	306.78	313.58	326.12	350.12	377.3	397.53	(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.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g ₁ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	4.65	x	11.28	x	0.55	x	0.7	=	14	(75)
Northeast 0.9x	0.77	x	4.65	x	22.97	x	0.55	x	0.7	=	28.49	(75)
Northeast 0.9x	0.77	x	4.65	x	41.38	x	0.55	x	0.7	=	51.34	(75)
Northeast 0.9x	0.77	x	4.65	x	67.96	x	0.55	x	0.7	=	84.31	(75)
Northeast 0.9x	0.77	x	4.65	x	91.35	x	0.55	x	0.7	=	113.33	(75)

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Northeast 0.9x	0.77	x	4.65	x	97.38	x	0.55	x	0.7	=	120.82	(75)
Northeast 0.9x	0.77	x	4.65	x	91.1	x	0.55	x	0.7	=	113.02	(75)
Northeast 0.9x	0.77	x	4.65	x	72.63	x	0.55	x	0.7	=	90.1	(75)
Northeast 0.9x	0.77	x	4.65	x	50.42	x	0.55	x	0.7	=	62.55	(75)
Northeast 0.9x	0.77	x	4.65	x	28.07	x	0.55	x	0.7	=	34.82	(75)
Northeast 0.9x	0.77	x	4.65	x	14.2	x	0.55	x	0.7	=	17.61	(75)
Northeast 0.9x	0.77	x	4.65	x	9.21	x	0.55	x	0.7	=	11.43	(75)
Southeast 0.9x	0.77	x	17.75	x	36.79	x	0.55	x	0.7	=	174.25	(77)
Southeast 0.9x	0.77	x	17.75	x	62.67	x	0.55	x	0.7	=	296.81	(77)
Southeast 0.9x	0.77	x	17.75	x	85.75	x	0.55	x	0.7	=	406.11	(77)
Southeast 0.9x	0.77	x	17.75	x	106.25	x	0.55	x	0.7	=	503.19	(77)
Southeast 0.9x	0.77	x	17.75	x	119.01	x	0.55	x	0.7	=	563.61	(77)
Southeast 0.9x	0.77	x	17.75	x	118.15	x	0.55	x	0.7	=	559.53	(77)
Southeast 0.9x	0.77	x	17.75	x	113.91	x	0.55	x	0.7	=	539.45	(77)
Southeast 0.9x	0.77	x	17.75	x	104.39	x	0.55	x	0.7	=	494.37	(77)
Southeast 0.9x	0.77	x	17.75	x	92.85	x	0.55	x	0.7	=	439.73	(77)
Southeast 0.9x	0.77	x	17.75	x	69.27	x	0.55	x	0.7	=	328.04	(77)
Southeast 0.9x	0.77	x	17.75	x	44.07	x	0.55	x	0.7	=	208.71	(77)
Southeast 0.9x	0.77	x	17.75	x	31.49	x	0.55	x	0.7	=	149.12	(77)
Southwest 0.9x	0.77	x	4.65	x	36.79		0.55	x	0.7	=	45.65	(79)
Southwest 0.9x	0.77	x	4.65	x	62.67		0.55	x	0.7	=	77.76	(79)
Southwest 0.9x	0.77	x	4.65	x	85.75		0.55	x	0.7	=	106.39	(79)
Southwest 0.9x	0.77	x	4.65	x	106.25		0.55	x	0.7	=	131.82	(79)
Southwest 0.9x	0.77	x	4.65	x	119.01		0.55	x	0.7	=	147.65	(79)
Southwest 0.9x	0.77	x	4.65	x	118.15		0.55	x	0.7	=	146.58	(79)
Southwest 0.9x	0.77	x	4.65	x	113.91		0.55	x	0.7	=	141.32	(79)
Southwest 0.9x	0.77	x	4.65	x	104.39		0.55	x	0.7	=	129.51	(79)
Southwest 0.9x	0.77	x	4.65	x	92.85		0.55	x	0.7	=	115.2	(79)
Southwest 0.9x	0.77	x	4.65	x	69.27		0.55	x	0.7	=	85.94	(79)
Southwest 0.9x	0.77	x	4.65	x	44.07		0.55	x	0.7	=	54.68	(79)
Southwest 0.9x	0.77	x	4.65	x	31.49		0.55	x	0.7	=	39.07	(79)
Northwest 0.9x	0.77	x	11.88	x	11.28	x	0.55	x	0.7	=	35.76	(81)
Northwest 0.9x	0.77	x	11.88	x	22.97	x	0.55	x	0.7	=	72.8	(81)
Northwest 0.9x	0.77	x	11.88	x	41.38	x	0.55	x	0.7	=	131.16	(81)
Northwest 0.9x	0.77	x	11.88	x	67.96	x	0.55	x	0.7	=	215.4	(81)
Northwest 0.9x	0.77	x	11.88	x	91.35	x	0.55	x	0.7	=	289.53	(81)
Northwest 0.9x	0.77	x	11.88	x	97.38	x	0.55	x	0.7	=	308.67	(81)
Northwest 0.9x	0.77	x	11.88	x	91.1	x	0.55	x	0.7	=	288.76	(81)
Northwest 0.9x	0.77	x	11.88	x	72.63	x	0.55	x	0.7	=	230.2	(81)
Northwest 0.9x	0.77	x	11.88	x	50.42	x	0.55	x	0.7	=	159.82	(81)
Northwest 0.9x	0.77	x	11.88	x	28.07	x	0.55	x	0.7	=	88.96	(81)

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Northwest 0.9x

0.77

 x

11.88

 x

14.2

 x

0.55

 x

0.7

 =

45

 (81)

Northwest 0.9x

0.77

 x

11.88

 x

9.21

 x

0.55

 x

0.7

 =

29.21

 (81)

Solar gains in watts, calculated for each month

(83)m =

269.66	475.85	694.99	934.71	1114.12	1135.61	1082.55	944.19	777.29	537.76	326	228.82
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 (83)

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

(84)m =

679.24	883.31	1087.82	1303.77	1458.94	1457.1	1389.33	1257.77	1103.42	887.87	703.29	626.35
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 (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	0.82	0.63	0.44	0.32	0.37	0.62	0.9	0.99	1

 (86)

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

(87)m =

19.85	20.12	20.46	20.8	20.95	20.99	21	21	20.97	20.71	20.2	19.8
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 (87)

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

(88)m =

19.92	19.93	19.93	19.94	19.94	19.96	19.96	19.96	19.95	19.94	19.94	19.93
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 (88)

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

(89)m =

0.99	0.97	0.92	0.77	0.57	0.37	0.25	0.29	0.53	0.87	0.98	0.99
------	------	------	------	------	------	------	------	------	------	------	------

 (89)

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

(90)m =

18.41	18.8	19.29	19.73	19.9	19.95	19.95	19.96	19.93	19.63	18.93	18.35
-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (90)

fLA = Living area ÷ (4) =

0.4

 (91)

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

(92)m =

18.98	19.32	19.75	20.15	20.32	20.36	20.37	20.37	20.34	20.06	19.43	18.92
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

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

(93)m =

18.83	19.17	19.6	20	20.17	20.21	20.22	20.22	20.19	19.91	19.28	18.77
-------	-------	------	----	-------	-------	-------	-------	-------	-------	-------	-------

 (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	0.97	0.91	0.78	0.58	0.39	0.27	0.31	0.55	0.86	0.98	0.99
------	------	------	------	------	------	------	------	------	------	------	------

 (94)

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

(95)m =

672.1	855.16	992.36	1013.26	848.17	570.97	369.75	388.86	609.71	767.7	685.74	621.68
-------	--------	--------	---------	--------	--------	--------	--------	--------	-------	--------	--------

 (95)

Monthly average external temperature from Table 8

(96)m =

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

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

(97)m =

1538.4	1507.46	1380.07	1153.87	877.88	574.28	370.11	389.61	626.39	965.04	1270.07	1526.93
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------

 (97)

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

(98)m =

644.53	438.35	288.46	101.24	22.11	0	0	0	0	146.82	420.71	673.51
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

 (98)

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

2735.72

 (98)

Space heating requirement in kWh/m²/year

30.91

 (99)

8c. Space cooling requirement

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

DER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	961.78	757.15	775.53	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	941.52	749.96	763.59	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1792.19	1711.21	1558.61	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m													
set (104)m to zero if (104)m < 3 x (98)m													
(104)m=	0	0	0	0	0	612.48	715.17	591.49	0	0	0	0	
									Total = Sum(104)	=	1919.14	(104)	
Cooled fraction										f C = cooled area ÷ (4) =	0.7	(105)	
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
									Total = Sum(104)	=	0	(106)	
Space cooling requirement for month = (104)m x (105) x (106)m													
(107)m=	0	0	0	0	0	107.27	125.26	103.59	0	0	0	0	
									Total = Sum(107)	=	336.12	(107)	
Space cooling requirement in kWh/m²/year										(107) ÷ (4) =	3.8	(108)	

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.13	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement (calculated above)	644.53	438.35	288.46	101.24	22.11	0	0	0	0	146.82	420.71	673.51	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													
	712.98	484.9	319.09	111.99	24.45	0	0	0	0	162.41	465.39	745.03	
											Total (kWh/year) = Sum(211) _{1...5,10, 12} =	3026.24	(211)

Space heating fuel (secondary), kWh/month													
= {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
											Total (kWh/year) = Sum(215) _{1...5,10, 12} =	0	(215)

Water heating

Output from water heater (calculated above)													
	207.66	183.08	191.35	169.72	164.32	144.72	138.66	154.57	156.28	177.95	189.06	202.71	
Efficiency of water heater												80.3	(216)
(217)m=	87.71	87.17	86.08	83.8	81.38	80.3	80.3	80.3	80.3	84.57	87.01	87.84	(217)

DER WorkSheet: New dwelling design stage

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	236.75	210.02	222.29	202.54	201.92	180.23	172.67	192.49	194.62	210.42	217.29	230.77	
Total = Sum(219a) _{1...12} =													2472.01 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

(221)m=	0	0	0	0	0	20.91	24.42	20.19	0	0	0	0	
Total = Sum(221) _{6...8} =													65.52 (221)

Annual totals

Space heating fuel used, main system 1

Water heating fuel used

Space cooling fuel used

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

central heating pump:

Total electricity for the above, kWh/year

Electricity for lighting

kWh/year

kWh/year

182.2 (230a)

30 (230c)

sum of (230a) (230g) = 212.2 (231)

372.02 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	653.67	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1187.62	(265)
Space cooling	(221) x	0.519	=	34.01	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	110.13	(267)
Electricity for lighting	(232) x	0.519	=	193.08	(268)
Total CO2, kg/year		sum of (265) (271) =		1524.84	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		17.23	(273)
El rating (section 14)				85	(274)

Appendix

Energy Assessment

Barrie House

GREEN Scenario

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.10

Property Address: Flat 01

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Basement	64.54 (1a) x	2.7 (2a) =	174.26 (3a)
Ground floor	32.28 (1b) x	3.27 (2b) =	105.56 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96.82 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	279.82 (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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
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)
<i>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</i>		
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)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.15 (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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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

	0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m=	0.31	0.3	0.3	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.29	0.29	(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=	0.31	0.3	0.3	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.29	0.29	(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			7.16	$\times 1/[1/(1.2) + 0.04] =$	8.2		(27)
Windows Type 2			1	$\times 1/[1/(1.2) + 0.04] =$	1.15		(27)
Windows Type 3			2.3	$\times 1/[1/(1.2) + 0.04] =$	2.63		(27)
Windows Type 4			9.45	$\times 1/[1/(1.2) + 0.04] =$	10.82		(27)
Floor			64.539	$\times 0.1 =$	6.4539		(28)
Walls Type1	23.54	0	23.54	$\times 0.16 =$	3.77		(29)
Walls Type2	54.89	19.91	34.98	$\times 0.16 =$	5.6		(29)
Walls Type3	31.15	0	31.15	$\times 0.16 =$	4.98		(29)
Roof	33.95	0	33.95	$\times 0.12 =$	4.07		(30)
Total area of elements, m²			208.07				(31)

* 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) = 47.67 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 22183.3 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 12.29 (36)

DER WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 59.96 (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=	28.51	28.16	27.82	26.09	25.74	24.01	24.01	23.66	24.7	25.74	26.43	27.12	(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=	88.47	88.12	87.78	86.04	85.7	83.97	83.97	83.62	84.66	85.7	86.39	87.08	
Average = Sum(39) ₁₋₁₂ / 12 =												85.96	(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=	0.91	0.91	0.91	0.89	0.89	0.87	0.87	0.86	0.87	0.89	0.89	0.9	
Average = Sum(40) ₁₋₁₂ / 12 =												0.89	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.71 (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 98.52 (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=	108.37	104.43	100.49	96.55	92.61	88.67	88.67	92.61	96.55	100.49	104.43	108.37	
Total = Sum(44) ₁₋₁₂ =												1182.2	(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=	160.71	140.56	145.04	126.45	121.33	104.7	97.02	111.33	112.66	131.3	143.32	155.64	
Total = Sum(45) ₁₋₁₂ =												1550.06	(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=	24.11	21.08	21.76	18.97	18.2	15.71	14.55	16.7	16.9	19.69	21.5	23.35	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

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

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
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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=

0	0	0	0	0	0	0	0	0	0	0	0
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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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

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

(61)m=

50.96	46.03	50.96	47.61	47.19	43.73	45.18	47.19	47.61	50.96	49.32	50.96
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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=

211.67	186.58	196	174.06	168.52	148.43	142.2	158.52	160.27	182.26	192.64	206.6
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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=

211.67	186.58	196	174.06	168.52	148.43	142.2	158.52	160.27	182.26	192.64	206.6
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Output from water heater (annual) _{1 12}	2127.75
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 (64)

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

(65)m=

66.18	58.24	60.97	53.95	52.14	45.74	43.55	48.82	49.36	56.4	59.98	64.49
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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
135.4	135.4	135.4	135.4	135.4	135.4	135.4	135.4	135.4	135.4	135.4	135.4

 (66)

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

(67)m=

22.48	19.97	16.24	12.29	9.19	7.76	8.38	10.9	14.63	18.57	21.68	23.11
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 (67)

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

(68)m=

251.08	253.69	247.12	233.15	215.5	198.92	187.84	185.23	191.8	205.78	223.42	240.01
--------	--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------

 (68)

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

(69)m=

36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54
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 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
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 (70)

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

(71)m=

-108.32	-108.32	-108.32	-108.32	-108.32	-108.32	-108.32	-108.32	-108.32	-108.32	-108.32	-108.32
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 (71)

Water heating gains (Table 5)

(72)m=

88.94	86.67	81.94	74.93	70.08	63.53	58.54	65.61	68.56	75.8	83.31	86.68
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 (72)

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

(73)m=

429.13	426.95	411.93	386.99	361.39	336.83	321.39	328.37	341.61	366.77	395.03	416.41
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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)	
Northeast 0.9x	0.77	x	2.3	x	11.28	x	0.55	x	0.7	=	6.92	(75)
Northeast 0.9x	0.77	x	2.3	x	22.97	x	0.55	x	0.7	=	14.09	(75)
Northeast 0.9x	0.77	x	2.3	x	41.38	x	0.55	x	0.7	=	25.39	(75)
Northeast 0.9x	0.77	x	2.3	x	67.96	x	0.55	x	0.7	=	41.7	(75)
Northeast 0.9x	0.77	x	2.3	x	91.35	x	0.55	x	0.7	=	56.05	(75)
Northeast 0.9x	0.77	x	2.3	x	97.38	x	0.55	x	0.7	=	59.76	(75)
Northeast 0.9x	0.77	x	2.3	x	91.1	x	0.55	x	0.7	=	55.9	(75)
Northeast 0.9x	0.77	x	2.3	x	72.63	x	0.55	x	0.7	=	44.57	(75)
Northeast 0.9x	0.77	x	2.3	x	50.42	x	0.55	x	0.7	=	30.94	(75)
Northeast 0.9x	0.77	x	2.3	x	28.07	x	0.55	x	0.7	=	17.22	(75)
Northeast 0.9x	0.77	x	2.3	x	14.2	x	0.55	x	0.7	=	8.71	(75)
Northeast 0.9x	0.77	x	2.3	x	9.21	x	0.55	x	0.7	=	5.65	(75)
Northwest 0.9x	0.77	x	7.16	x	11.28	x	0.55	x	0.7	=	21.55	(81)
Northwest 0.9x	0.77	x	1	x	11.28	x	0.55	x	0.7	=	3.01	(81)
Northwest 0.9x	0.77	x	9.45	x	11.28	x	0.55	x	0.7	=	28.45	(81)
Northwest 0.9x	0.77	x	7.16	x	22.97	x	0.55	x	0.7	=	43.87	(81)
Northwest 0.9x	0.77	x	1	x	22.97	x	0.55	x	0.7	=	6.13	(81)
Northwest 0.9x	0.77	x	9.45	x	22.97	x	0.55	x	0.7	=	57.91	(81)
Northwest 0.9x	0.77	x	7.16	x	41.38	x	0.55	x	0.7	=	79.05	(81)
Northwest 0.9x	0.77	x	1	x	41.38	x	0.55	x	0.7	=	11.04	(81)
Northwest 0.9x	0.77	x	9.45	x	41.38	x	0.55	x	0.7	=	104.33	(81)
Northwest 0.9x	0.77	x	7.16	x	67.96	x	0.55	x	0.7	=	129.82	(81)
Northwest 0.9x	0.77	x	1	x	67.96	x	0.55	x	0.7	=	18.13	(81)
Northwest 0.9x	0.77	x	9.45	x	67.96	x	0.55	x	0.7	=	171.34	(81)
Northwest 0.9x	0.77	x	7.16	x	91.35	x	0.55	x	0.7	=	174.5	(81)
Northwest 0.9x	0.77	x	1	x	91.35	x	0.55	x	0.7	=	24.37	(81)
Northwest 0.9x	0.77	x	9.45	x	91.35	x	0.55	x	0.7	=	230.31	(81)
Northwest 0.9x	0.77	x	7.16	x	97.38	x	0.55	x	0.7	=	186.04	(81)
Northwest 0.9x	0.77	x	1	x	97.38	x	0.55	x	0.7	=	25.98	(81)
Northwest 0.9x	0.77	x	9.45	x	97.38	x	0.55	x	0.7	=	245.54	(81)
Northwest 0.9x	0.77	x	7.16	x	91.1	x	0.55	x	0.7	=	174.03	(81)
Northwest 0.9x	0.77	x	1	x	91.1	x	0.55	x	0.7	=	24.31	(81)
Northwest 0.9x	0.77	x	9.45	x	91.1	x	0.55	x	0.7	=	229.69	(81)
Northwest 0.9x	0.77	x	7.16	x	72.63	x	0.55	x	0.7	=	138.74	(81)
Northwest 0.9x	0.77	x	1	x	72.63	x	0.55	x	0.7	=	19.38	(81)
Northwest 0.9x	0.77	x	9.45	x	72.63	x	0.55	x	0.7	=	183.11	(81)
Northwest 0.9x	0.77	x	7.16	x	50.42	x	0.55	x	0.7	=	96.32	(81)
Northwest 0.9x	0.77	x	1	x	50.42	x	0.55	x	0.7	=	13.45	(81)
Northwest 0.9x	0.77	x	9.45	x	50.42	x	0.55	x	0.7	=	127.13	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	7.16	x	28.07	x	0.55	x	0.7	=	53.62	(81)
Northwest 0.9x	0.77	x	1	x	28.07	x	0.55	x	0.7	=	7.49	(81)
Northwest 0.9x	0.77	x	9.45	x	28.07	x	0.55	x	0.7	=	70.77	(81)
Northwest 0.9x	0.77	x	7.16	x	14.2	x	0.55	x	0.7	=	27.12	(81)
Northwest 0.9x	0.77	x	1	x	14.2	x	0.55	x	0.7	=	3.79	(81)
Northwest 0.9x	0.77	x	9.45	x	14.2	x	0.55	x	0.7	=	35.79	(81)
Northwest 0.9x	0.77	x	7.16	x	9.21	x	0.55	x	0.7	=	17.6	(81)
Northwest 0.9x	0.77	x	1	x	9.21	x	0.55	x	0.7	=	2.46	(81)
Northwest 0.9x	0.77	x	9.45	x	9.21	x	0.55	x	0.7	=	23.23	(81)

Solar gains in watts, calculated for each month

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

(83)m=	59.94	122	219.81	360.99	485.24	517.31	483.94	385.8	267.84	149.1	75.41	48.95	(83)
--------	-------	-----	--------	--------	--------	--------	--------	-------	--------	-------	-------	-------	------

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

(84)m=	489.07	548.95	631.74	747.98	846.63	854.15	805.32	714.17	609.45	515.87	470.44	465.36	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.83	0.62	0.46	0.53	0.84	0.99	1	1	(86)

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

(87)m=	20	20.12	20.34	20.67	20.91	20.99	21	21	20.93	20.61	20.26	19.99	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.16	20.18	20.18	20.2	20.2	20.2	20.19	20.18	20.17	20.17	(88)
--------	-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.95	0.79	0.54	0.37	0.44	0.78	0.98	1	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.8	18.97	19.31	19.79	20.09	20.19	20.19	20.2	20.13	19.71	19.19	18.79	(90)
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fLA = Living area ÷ (4) =

0.22 (91)

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

(92)m=	19.06	19.23	19.54	19.98	20.27	20.36	20.37	20.37	20.31	19.91	19.42	19.05	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.91	19.08	19.39	19.83	20.12	20.21	20.22	20.22	20.16	19.76	19.27	18.9	(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=	1	1	0.99	0.94	0.78	0.55	0.38	0.45	0.78	0.97	1	1	(94)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(95)m=	488.23	546.88	623.65	702.28	664.16	466.46	303.7	318.59	474.44	502.26	468.65	464.77	(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=	1292.73	1249.2	1131.17	940.48	721.66	471.41	304.09	319.66	512.7	784.7	1051.74	1280.39	(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=	598.55	471.96	377.59	171.51	42.78	0	0	0	0	210.14	419.83	606.82	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2899.17 (98)

Space heating requirement in kWh/m²/year

29.94 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	789.29	621.36	635.52	0	0	0	0	(100)

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.96	0.98	0.97	0	0	0	0	(101)
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Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	758.57	611.27	616.35	0	0	0	0	(102)
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Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1092.6	1033.62	928.38	0	0	0	0	(103)
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Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$

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

(104)m=	0	0	0	0	0	240.5	314.23	232.15	0	0	0	0	
Total = Sum(104) =													786.88 (104)

Cooled fraction

f C = cooled area ÷ (4) =

0.69 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104) =													0 (106)

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

(107)m=	0	0	0	0	0	41.61	54.36	40.16	0	0	0	0	
Total = Sum(107) =													136.13 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) =

1.41 (108)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) x [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.13 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement (calculated above)	598.55	471.96	377.59	171.51	42.78	0	0	0	0	210.14	419.83	606.82	

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

(211)m=	662.11	522.08	417.69	189.72	47.32	0	0	0	0	232.45	464.41	671.26	
Total (kWh/year) = Sum(211) _{1...5,10...12} =													3207.05 (211)

Space heating fuel (secondary), kWh/month

= $\{[(98)m \times (201)]\} \times 100 \div (208)$

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1...5,10...12} =													0 (215)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

211.67	186.58	196	174.06	168.52	148.43	142.2	158.52	160.27	182.26	192.64	206.6
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Efficiency of water heater

80.3 (216)

(217)m= 87.52 87.29 86.67 85.01 82.16 80.3 80.3 80.3 80.3 85.41 86.96 87.6 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

241.84	213.75	226.13	204.75	205.12	184.84	177.09	197.41	199.59	213.39	221.52	235.84
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Total = Sum(219a)_{1...12} = 2521.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	8.11	10.6	7.83	0	0	0	0
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Total = Sum(221)_{6...8} = 26.54 (221)

Annual totals

Space heating fuel used, main system 1

3207.05 kWh/year

Water heating fuel used

2521.27 kWh/year

Space cooling fuel used

26.54 kWh/year

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

183.49 (230a)

central heating pump:

30 (230c)

Total electricity for the above, kWh/year

sum of (230a) (230g) = 213.49 (231)

Electricity for lighting

397.05 (232)

Electricity generated by PVs

-271.71 (233)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	692.72 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	544.59 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1237.32 (265)
Space cooling	(221) x	0.519 =	13.77 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	110.8 (267)
Electricity for lighting	(232) x	0.519 =	206.07 (268)
Energy saving/generation technologies Item 1		0.519 =	-141.02 (269)
Total CO2, kg/year		sum of (265) (271) =	1426.94 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	14.74 (273)
EI rating (section 14)			87 (274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.10

Property Address: Flat 02

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Basement	52.41 (1a)	x	2.7 (2a)	=	141.51 (3a)
Ground floor	32.02 (1b)	x	3.27 (2b)	=	104.71 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	84.43 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	246.22 (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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
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)
<i>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</i>			
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)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.15 (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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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
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18
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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) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

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

73.95 (23c)

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

(24a)m=	0.32	0.32	0.31	0.3	0.29	0.27	0.27	0.27	0.28	0.29	0.3	0.31	(24a)
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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)
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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=	0.32	0.32	0.31	0.3	0.29	0.27	0.27	0.27	0.28	0.29	0.3	0.31	(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			8.51	$x1/[1/(1.2)+0.04] =$	9.74		(27)
Windows Type 2			2.3	$x1/[1/(1.2)+0.04] =$	2.63		(27)
Windows Type 3			9.45	$x1/[1/(1.2)+0.04] =$	10.82		(27)
Windows Type 4			9.56	$x1/[1/(1.2)+0.04] =$	10.95		(27)
Windows Type 5			4.65	$x1/[1/(1.2)+0.04] =$	5.32		(27)
Floor			52.412	x 0.1	5.2412		(28)
Walls Type1	27.27	0	27.27	x 0.16	4.36		(29)
Walls Type2	76.5	34.47	42.03	x 0.16	6.73		(29)
Walls Type3	12.09	0	12.09	x 0.16	1.93		(29)
Roof	20.39	0	20.39	x 0.12	2.45		(30)
Total area of elements, m²			188.66				(31)

* 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) = 60.18 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 19578.53 (34)

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

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

DER WorkSheet: New dwelling design stage

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

12.8 (36)

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

Total fabric heat loss

(33) + (36) =

72.98 (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=	26.12	25.82	25.51	23.99	23.68	22.16	22.16	21.86	22.77	23.68	24.29	24.9

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	99.1	98.8	98.49	96.97	96.66	95.14	95.14	94.84	95.75	96.66	97.27	97.88
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Average = Sum(39)₁₋₁₂ / 12 =

96.89 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=	1.17	1.17	1.17	1.15	1.14	1.13	1.13	1.12	1.13	1.14	1.15	1.16
--------	------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)₁₋₁₂ / 12 =

1.15 (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

2.54

(42)

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

94.56

(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=	104.02	100.24	96.45	92.67	88.89	85.11	85.11	88.89	92.67	96.45	100.24	104.02
--------	--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

Total = Sum(44)₁₋₁₂ =

1134.76 (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=	154.26	134.91	139.22	121.38	116.46	100.5	93.13	106.86	108.14	126.03	137.57	149.39
--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Total = Sum(45)₁₋₁₂ =

1487.84 (45)

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

(46)m=	23.14	20.24	20.88	18.21	17.47	15.07	13.97	16.03	16.22	18.9	20.64	22.41
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

DER WorkSheet: New dwelling design stage

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

0
0

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

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

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

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

(61)m=

50.96	46.03	49.15	45.7	45.3	41.97	43.37	45.3	45.7	49.15	49.32	50.96
-------	-------	-------	------	------	-------	-------	------	------	-------	-------	-------

(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=

205.22	180.94	188.37	167.08	161.76	142.47	136.5	152.16	153.84	175.18	186.88	200.35
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

(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=

205.22	180.94	188.37	167.08	161.76	142.47	136.5	152.16	153.84	175.18	186.88	200.35
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

(64)

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

2050.74

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=

64.03	56.37	58.58	51.78	50.05	43.91	41.81	46.86	47.38	54.19	58.07	62.41
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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
127.08	127.08	127.08	127.08	127.08	127.08	127.08	127.08	127.08	127.08	127.08	127.08

(66)

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

(67)m=

20.37	18.09	14.71	11.14	8.33	7.03	7.59	9.87	13.25	16.82	19.64	20.93
-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

(67)

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

(68)m=

228.45	230.82	224.85	212.13	196.08	180.99	170.91	168.54	174.51	187.23	203.29	218.37
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

35.71	35.71	35.71	35.71	35.71	35.71	35.71	35.71	35.71	35.71	35.71	35.71
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

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

(71)m=

-101.66	-101.66	-101.66	-101.66	-101.66	-101.66	-101.66	-101.66	-101.66	-101.66	-101.66	-101.66
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

86.06	83.88	78.73	71.92	67.27	60.98	56.19	62.98	65.81	72.84	80.65	83.89
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

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

(73)m=

399.01	396.92	382.42	359.31	335.8	313.13	298.82	305.51	317.7	341.02	367.7	387.32
--------	--------	--------	--------	-------	--------	--------	--------	-------	--------	-------	--------

(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)	
Northeast 0.9x	0.77	x	9.56	x	11.28	x	0.55	x	0.7	=	28.78	(75)
Northeast 0.9x	0.77	x	4.65	x	11.28	x	0.55	x	0.7	=	14	(75)
Northeast 0.9x	0.77	x	9.56	x	22.97	x	0.55	x	0.7	=	58.58	(75)
Northeast 0.9x	0.77	x	4.65	x	22.97	x	0.55	x	0.7	=	28.49	(75)
Northeast 0.9x	0.77	x	9.56	x	41.38	x	0.55	x	0.7	=	105.54	(75)
Northeast 0.9x	0.77	x	4.65	x	41.38	x	0.55	x	0.7	=	51.34	(75)
Northeast 0.9x	0.77	x	9.56	x	67.96	x	0.55	x	0.7	=	173.33	(75)
Northeast 0.9x	0.77	x	4.65	x	67.96	x	0.55	x	0.7	=	84.31	(75)
Northeast 0.9x	0.77	x	9.56	x	91.35	x	0.55	x	0.7	=	232.99	(75)
Northeast 0.9x	0.77	x	4.65	x	91.35	x	0.55	x	0.7	=	113.33	(75)
Northeast 0.9x	0.77	x	9.56	x	97.38	x	0.55	x	0.7	=	248.39	(75)
Northeast 0.9x	0.77	x	4.65	x	97.38	x	0.55	x	0.7	=	120.82	(75)
Northeast 0.9x	0.77	x	9.56	x	91.1	x	0.55	x	0.7	=	232.37	(75)
Northeast 0.9x	0.77	x	4.65	x	91.1	x	0.55	x	0.7	=	113.02	(75)
Northeast 0.9x	0.77	x	9.56	x	72.63	x	0.55	x	0.7	=	185.25	(75)
Northeast 0.9x	0.77	x	4.65	x	72.63	x	0.55	x	0.7	=	90.1	(75)
Northeast 0.9x	0.77	x	9.56	x	50.42	x	0.55	x	0.7	=	128.61	(75)
Northeast 0.9x	0.77	x	4.65	x	50.42	x	0.55	x	0.7	=	62.55	(75)
Northeast 0.9x	0.77	x	9.56	x	28.07	x	0.55	x	0.7	=	71.59	(75)
Northeast 0.9x	0.77	x	4.65	x	28.07	x	0.55	x	0.7	=	34.82	(75)
Northeast 0.9x	0.77	x	9.56	x	14.2	x	0.55	x	0.7	=	36.21	(75)
Northeast 0.9x	0.77	x	4.65	x	14.2	x	0.55	x	0.7	=	17.61	(75)
Northeast 0.9x	0.77	x	9.56	x	9.21	x	0.55	x	0.7	=	23.5	(75)
Northeast 0.9x	0.77	x	4.65	x	9.21	x	0.55	x	0.7	=	11.43	(75)
Southwest 0.9x	0.77	x	2.3	x	36.79		0.55	x	0.7	=	22.58	(79)
Southwest 0.9x	0.77	x	2.3	x	62.67		0.55	x	0.7	=	38.46	(79)
Southwest 0.9x	0.77	x	2.3	x	85.75		0.55	x	0.7	=	52.62	(79)
Southwest 0.9x	0.77	x	2.3	x	106.25		0.55	x	0.7	=	65.2	(79)
Southwest 0.9x	0.77	x	2.3	x	119.01		0.55	x	0.7	=	73.03	(79)
Southwest 0.9x	0.77	x	2.3	x	118.15		0.55	x	0.7	=	72.5	(79)
Southwest 0.9x	0.77	x	2.3	x	113.91		0.55	x	0.7	=	69.9	(79)
Southwest 0.9x	0.77	x	2.3	x	104.39		0.55	x	0.7	=	64.06	(79)
Southwest 0.9x	0.77	x	2.3	x	92.85		0.55	x	0.7	=	56.98	(79)
Southwest 0.9x	0.77	x	2.3	x	69.27		0.55	x	0.7	=	42.51	(79)
Southwest 0.9x	0.77	x	2.3	x	44.07		0.55	x	0.7	=	27.04	(79)
Southwest 0.9x	0.77	x	2.3	x	31.49		0.55	x	0.7	=	19.32	(79)
Northwest 0.9x	0.77	x	8.51	x	11.28	x	0.55	x	0.7	=	25.62	(81)
Northwest 0.9x	0.77	x	9.45	x	11.28	x	0.55	x	0.7	=	28.45	(81)
Northwest 0.9x	0.77	x	8.51	x	22.97	x	0.55	x	0.7	=	52.15	(81)

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Northwest 0.9x	0.77	x	9.45	x	22.97	x	0.55	x	0.7	=	57.91	(81)
Northwest 0.9x	0.77	x	8.51	x	41.38	x	0.55	x	0.7	=	93.95	(81)
Northwest 0.9x	0.77	x	9.45	x	41.38	x	0.55	x	0.7	=	104.33	(81)
Northwest 0.9x	0.77	x	8.51	x	67.96	x	0.55	x	0.7	=	154.29	(81)
Northwest 0.9x	0.77	x	9.45	x	67.96	x	0.55	x	0.7	=	171.34	(81)
Northwest 0.9x	0.77	x	8.51	x	91.35	x	0.55	x	0.7	=	207.4	(81)
Northwest 0.9x	0.77	x	9.45	x	91.35	x	0.55	x	0.7	=	230.31	(81)
Northwest 0.9x	0.77	x	8.51	x	97.38	x	0.55	x	0.7	=	221.11	(81)
Northwest 0.9x	0.77	x	9.45	x	97.38	x	0.55	x	0.7	=	245.54	(81)
Northwest 0.9x	0.77	x	8.51	x	91.1	x	0.55	x	0.7	=	206.85	(81)
Northwest 0.9x	0.77	x	9.45	x	91.1	x	0.55	x	0.7	=	229.69	(81)
Northwest 0.9x	0.77	x	8.51	x	72.63	x	0.55	x	0.7	=	164.9	(81)
Northwest 0.9x	0.77	x	9.45	x	72.63	x	0.55	x	0.7	=	183.11	(81)
Northwest 0.9x	0.77	x	8.51	x	50.42	x	0.55	x	0.7	=	114.48	(81)
Northwest 0.9x	0.77	x	9.45	x	50.42	x	0.55	x	0.7	=	127.13	(81)
Northwest 0.9x	0.77	x	8.51	x	28.07	x	0.55	x	0.7	=	63.73	(81)
Northwest 0.9x	0.77	x	9.45	x	28.07	x	0.55	x	0.7	=	70.77	(81)
Northwest 0.9x	0.77	x	8.51	x	14.2	x	0.55	x	0.7	=	32.23	(81)
Northwest 0.9x	0.77	x	9.45	x	14.2	x	0.55	x	0.7	=	35.79	(81)
Northwest 0.9x	0.77	x	8.51	x	9.21	x	0.55	x	0.7	=	20.92	(81)
Northwest 0.9x	0.77	x	9.45	x	9.21	x	0.55	x	0.7	=	23.23	(81)

Solar gains in watts, calculated for each month

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

(83)m=	119.42	235.59	407.78	648.47	857.06	908.37	851.83	687.42	489.75	283.41	148.9	98.41	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	518.43	632.5	790.2	1007.79	1192.86	1221.49	1150.65	992.94	807.44	624.43	516.6	485.73	(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=	1	0.99	0.98	0.89	0.7	0.49	0.36	0.44	0.74	0.96	1	1	(86)

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

(87)m=	19.74	19.93	20.27	20.69	20.93	20.99	21	21	20.93	20.55	20.07	19.71	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	19.94	19.94	19.95	19.96	19.96	19.98	19.98	19.98	19.97	19.96	19.96	19.95	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.97	0.86	0.64	0.42	0.28	0.34	0.66	0.95	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	18.27	18.55	19.04	19.62	19.9	19.97	19.98	19.98	19.92	19.45	18.76	18.23	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.25

(91)

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

DER WorkSheet: New dwelling design stage

(92)m=	18.63	18.89	19.34	19.89	20.16	20.23	20.23	20.23	20.17	19.73	19.08	18.6	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(93)m=	18.48	18.74	19.19	19.74	20.01	20.08	20.08	20.08	20.02	19.58	18.93	18.45	(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=	1	0.99	0.96	0.85	0.64	0.42	0.29	0.35	0.66	0.94	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	516.06	624.99	758.4	857.9	763.78	517.18	330.92	348.25	535.5	585.83	511.45	484.09	(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	1405.51	1367.78	1250.34	1051.2	803.03	521.05	331.33	349.32	567.26	867.65	1151.1	1395	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	------	------

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

(98)m=	661.75	499.15	366	139.17	29.2	0	0	0	0	209.67	460.55	677.72	
--------	--------	--------	-----	--------	------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 3043.22 (98)

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

36.04 (99)

8c. Space cooling requirement

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

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

Heat loss rate L_m (calculated using $25^\circ C$ internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	894.31	704.03	720.75	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss h_m

(101)m=	0	0	0	0	0	0.97	0.99	0.97	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss, $h_m L_m$ (Watts) = $(100)m \times (101)m$

(102)m=	0	0	0	0	0	868.42	694.32	701.69	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1514.04	1429.54	1246.32	0	0	0	0	(103)
---------	---	---	---	---	---	---------	---------	---------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$

set $(104)m$ to zero if $(104)m < 3 \times (98)m$

(104)m=	0	0	0	0	0	464.85	547	405.2	0	0	0	0	
---------	---	---	---	---	---	--------	-----	-------	---	---	---	---	--

Total = $Sum(104) =$ 1417.06 (104)

Cooled fraction

$f_C = \text{cooled area} \div (4) =$ 0.71 (105)

Intermittency factor (Table 10b)

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

Total = $Sum(104) =$ 0 (106)

Space cooling requirement for month = $(104)m \times (105) \times (106)m$

(107)m=	0	0	0	0	0	82.58	97.18	71.99	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = $Sum(107) =$ 251.75 (107)

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

$(107) \div (4) =$ 2.98 (108)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

DER WorkSheet: New dwelling design stage

Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		4.86	(209)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
661.75	499.15	366	139.17	29.2	0	0	0	0	209.67	460.55	677.72	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												
732.03	552.16	404.87	153.95	32.3	0	0	0	0	231.93	509.46	749.68	
Total (kWh/year) = Sum(211) _{1..5,10, 12} =												3366.39

Space heating fuel (secondary), kWh/month												
= {[(98)m x (201)] } x 100 ÷ (208)												
(215)m =	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10, 12} =												0

Water heating

Output from water heater (calculated above)	205.22	180.94	188.37	167.08	161.76	142.47	136.5	152.16	153.84	175.18	186.88	200.35
Efficiency of water heater												80.3
(217)m =	87.79	87.47	86.69	84.6	81.7	80.3	80.3	80.3	80.3	85.5	87.23	87.88
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m =	233.77	206.86	217.28	197.5	198	177.42	169.98	189.49	191.58	204.88	214.23	227.99
Total = Sum(219a) _{1..12} =												2428.98

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)												
(221)m =	0	0	0	0	0	16.99	20	14.81	0	0	0	0
Total = Sum(221) _{6..8} =												51.8

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		3366.39
Water heating fuel used		2428.98
Space cooling fuel used		51.8
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	202.76	(230a)
central heating pump:	30	(230c)
Total electricity for the above, kWh/year	sum of (230a) (230g) =	232.76
Electricity for lighting		359.68
Electricity generated by PVs		-271.71

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

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

DER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	727.14	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1251.8	(265)
Space cooling	(221) x	0.519	=	26.88	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	120.8	(267)
Electricity for lighting	(232) x	0.519	=	186.68	(268)
Energy saving/generation technologies Item 1		0.519	=	-141.02	(269)
Total CO2, kg/year	sum of (265) (271) =			1445.15	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			17.12	(273)
El rating (section 14)				85	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.10

Property Address: Flat 03

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Basement	63.22 (1a) x	2.7 (2a) =	170.69 (3a)
Ground floor	39.79 (1b) x	3.27 (2b) =	130.12 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	103.01 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	300.81 (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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
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)
<i>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</i>		
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)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.15 (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

	0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18
--	------	------	------	------	------	------	------	------	------	------	------	------

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) =

73.95 (23c)

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

(24a)m=	0.32	0.32	0.31	0.3	0.29	0.27	0.27	0.27	0.28	0.29	0.3	0.31
---------	------	------	------	-----	------	------	------	------	------	------	-----	------

(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=	0.32	0.32	0.31	0.3	0.29	0.27	0.27	0.27	0.28	0.29	0.3	0.31
--------	------	------	------	-----	------	------	------	------	------	------	-----	------

(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			8.51	$x1/[1/(1.2)+0.04] =$	9.74		(27)
Windows Type 2			2.3	$x1/[1/(1.2)+0.04] =$	2.63		(27)
Windows Type 3			9.45	$x1/[1/(1.2)+0.04] =$	10.82		(27)
Windows Type 4			6.41	$x1/[1/(1.2)+0.04] =$	7.34		(27)
Windows Type 5			2.3	$x1/[1/(1.2)+0.04] =$	2.63		(27)
Windows Type 6			2.3	$x1/[1/(1.2)+0.04] =$	2.63		(27)
Windows Type 7			4.65	$x1/[1/(1.2)+0.04] =$	5.32		(27)
Floor			63.22	x 0.1	6.322		(28)
Walls Type1	29.04	0	29.04	x 0.16	4.65		(29)
Walls Type2	80.83	35.92	44.91	x 0.16	7.19		(29)
Walls Type3	13.42	0	13.42	x 0.16	2.15		(29)
Roof	24.91	0	24.91	x 0.12	2.99		(30)
Total area of elements, m²			211.42				(31)

* 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) =

64.42 (33)

Heat capacity Cm = S(A x k)

((28) (30) + (32) + (32a) (32e) =

21566.03 (34)

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

Indicative Value: Medium

250 (35)

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

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can be used instead of a detailed calculation.

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

13.7 (36)

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

Total fabric heat loss

(33) + (36) =

78.12 (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=	31.91	31.54	31.17	29.31	28.94	27.08	27.08	26.7	27.82	28.94	29.68	30.43

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	110.04	109.67	109.29	107.43	107.06	105.2	105.2	104.83	105.94	107.06	107.81	108.55
--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Average = Sum(39)₁₋₁₂ / 12 =

107.34 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=	1.07	1.06	1.06	1.04	1.04	1.02	1.02	1.02	1.03	1.04	1.05	1.05
--------	------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)₁₋₁₂ / 12 =

1.04 (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

2.77

(42)

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

if TFA ≤ 13.9, N = 1

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

99.89

(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)

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

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

(44)m=	109.87	105.88	101.88	97.89	93.89	89.9	89.9	93.89	97.89	101.88	105.88	109.87
--------	--------	--------	--------	-------	-------	------	------	-------	-------	--------	--------	--------

Total = Sum(44)₁₋₁₂ =

1198.63 (44)

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

(45)m=	162.94	142.51	147.06	128.21	123.02	106.15	98.37	112.88	114.23	133.12	145.31	157.8
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------

Total = Sum(45)₁₋₁₂ =

1571.59 (45)

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

(46)m=	24.44	21.38	22.06	19.23	18.45	15.92	14.76	16.93	17.13	19.97	21.8	23.67
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$

0
0

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

0

 (55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (56)

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

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

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=

50.96	46.03	50.96	48.27	47.85	44.33	45.81	47.85	48.27	50.96	49.32	50.96
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (61)

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

(62)m=

213.9	188.54	198.01	176.48	170.86	150.49	144.18	160.73	162.5	184.08	194.63	208.76
-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 (62)

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

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

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (63)

Output from water heater

(64)m=

213.9	188.54	198.01	176.48	170.86	150.49	144.18	160.73	162.5	184.08	194.63	208.76
-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

Output from water heater (annual) _{1 12}	2153.15
---	---------

 (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=

66.92	58.89	61.64	54.7	52.86	46.38	44.16	49.49	50.05	57	60.64	65.21
-------	-------	-------	------	-------	-------	-------	-------	-------	----	-------	-------

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
138.29	138.29	138.29	138.29	138.29	138.29	138.29	138.29	138.29	138.29	138.29	138.29

 (66)

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

(67)m=

23.28	20.68	16.81	12.73	9.52	8.03	8.68	11.28	15.14	19.23	22.44	23.92
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

261.11	263.82	256.99	242.45	224.1	206.86	195.34	192.63	199.46	213.99	232.34	249.58
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

36.83	36.83	36.83	36.83	36.83	36.83	36.83	36.83	36.83	36.83	36.83	36.83
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

 (70)

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

(71)m=

-110.63	-110.63	-110.63	-110.63	-110.63	-110.63	-110.63	-110.63	-110.63	-110.63	-110.63	-110.63
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

89.94	87.64	82.84	75.97	71.06	64.42	59.35	66.52	69.51	76.62	84.23	87.64
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

441.81	439.61	424.13	398.64	372.16	346.79	330.86	337.92	351.6	377.32	406.5	428.64
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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)	
Northeast 0.9x	0.77	x	6.41	x	11.28	x	0.55	x	0.7	=	19.3	(75)
Northeast 0.9x	0.77	x	4.65	x	11.28	x	0.55	x	0.7	=	14	(75)
Northeast 0.9x	0.77	x	6.41	x	22.97	x	0.55	x	0.7	=	39.28	(75)
Northeast 0.9x	0.77	x	4.65	x	22.97	x	0.55	x	0.7	=	28.49	(75)
Northeast 0.9x	0.77	x	6.41	x	41.38	x	0.55	x	0.7	=	70.77	(75)
Northeast 0.9x	0.77	x	4.65	x	41.38	x	0.55	x	0.7	=	51.34	(75)
Northeast 0.9x	0.77	x	6.41	x	67.96	x	0.55	x	0.7	=	116.22	(75)
Northeast 0.9x	0.77	x	4.65	x	67.96	x	0.55	x	0.7	=	84.31	(75)
Northeast 0.9x	0.77	x	6.41	x	91.35	x	0.55	x	0.7	=	156.22	(75)
Northeast 0.9x	0.77	x	4.65	x	91.35	x	0.55	x	0.7	=	113.33	(75)
Northeast 0.9x	0.77	x	6.41	x	97.38	x	0.55	x	0.7	=	166.55	(75)
Northeast 0.9x	0.77	x	4.65	x	97.38	x	0.55	x	0.7	=	120.82	(75)
Northeast 0.9x	0.77	x	6.41	x	91.1	x	0.55	x	0.7	=	155.8	(75)
Northeast 0.9x	0.77	x	4.65	x	91.1	x	0.55	x	0.7	=	113.02	(75)
Northeast 0.9x	0.77	x	6.41	x	72.63	x	0.55	x	0.7	=	124.21	(75)
Northeast 0.9x	0.77	x	4.65	x	72.63	x	0.55	x	0.7	=	90.1	(75)
Northeast 0.9x	0.77	x	6.41	x	50.42	x	0.55	x	0.7	=	86.23	(75)
Northeast 0.9x	0.77	x	4.65	x	50.42	x	0.55	x	0.7	=	62.55	(75)
Northeast 0.9x	0.77	x	6.41	x	28.07	x	0.55	x	0.7	=	48	(75)
Northeast 0.9x	0.77	x	4.65	x	28.07	x	0.55	x	0.7	=	34.82	(75)
Northeast 0.9x	0.77	x	6.41	x	14.2	x	0.55	x	0.7	=	24.28	(75)
Northeast 0.9x	0.77	x	4.65	x	14.2	x	0.55	x	0.7	=	17.61	(75)
Northeast 0.9x	0.77	x	6.41	x	9.21	x	0.55	x	0.7	=	15.76	(75)
Northeast 0.9x	0.77	x	4.65	x	9.21	x	0.55	x	0.7	=	11.43	(75)
Southeast 0.9x	0.77	x	8.51	x	36.79	x	0.55	x	0.7	=	83.54	(77)
Southeast 0.9x	0.77	x	9.45	x	36.79	x	0.55	x	0.7	=	92.77	(77)
Southeast 0.9x	0.77	x	2.3	x	36.79	x	0.55	x	0.7	=	22.58	(77)
Southeast 0.9x	0.77	x	8.51	x	62.67	x	0.55	x	0.7	=	142.3	(77)
Southeast 0.9x	0.77	x	9.45	x	62.67	x	0.55	x	0.7	=	158.02	(77)
Southeast 0.9x	0.77	x	2.3	x	62.67	x	0.55	x	0.7	=	38.46	(77)
Southeast 0.9x	0.77	x	8.51	x	85.75	x	0.55	x	0.7	=	194.7	(77)
Southeast 0.9x	0.77	x	9.45	x	85.75	x	0.55	x	0.7	=	216.21	(77)
Southeast 0.9x	0.77	x	2.3	x	85.75	x	0.55	x	0.7	=	52.62	(77)
Southeast 0.9x	0.77	x	8.51	x	106.25	x	0.55	x	0.7	=	241.25	(77)
Southeast 0.9x	0.77	x	9.45	x	106.25	x	0.55	x	0.7	=	267.89	(77)
Southeast 0.9x	0.77	x	2.3	x	106.25	x	0.55	x	0.7	=	65.2	(77)
Southeast 0.9x	0.77	x	8.51	x	119.01	x	0.55	x	0.7	=	270.21	(77)
Southeast 0.9x	0.77	x	9.45	x	119.01	x	0.55	x	0.7	=	300.06	(77)
Southeast 0.9x	0.77	x	2.3	x	119.01	x	0.55	x	0.7	=	73.03	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	8.51	x	118.15	x	0.55	x	0.7	=	268.26	(77)
Southeast 0.9x	0.77	x	9.45	x	118.15	x	0.55	x	0.7	=	297.89	(77)
Southeast 0.9x	0.77	x	2.3	x	118.15	x	0.55	x	0.7	=	72.5	(77)
Southeast 0.9x	0.77	x	8.51	x	113.91	x	0.55	x	0.7	=	258.63	(77)
Southeast 0.9x	0.77	x	9.45	x	113.91	x	0.55	x	0.7	=	287.2	(77)
Southeast 0.9x	0.77	x	2.3	x	113.91	x	0.55	x	0.7	=	69.9	(77)
Southeast 0.9x	0.77	x	8.51	x	104.39	x	0.55	x	0.7	=	237.02	(77)
Southeast 0.9x	0.77	x	9.45	x	104.39	x	0.55	x	0.7	=	263.2	(77)
Southeast 0.9x	0.77	x	2.3	x	104.39	x	0.55	x	0.7	=	64.06	(77)
Southeast 0.9x	0.77	x	8.51	x	92.85	x	0.55	x	0.7	=	210.82	(77)
Southeast 0.9x	0.77	x	9.45	x	92.85	x	0.55	x	0.7	=	234.11	(77)
Southeast 0.9x	0.77	x	2.3	x	92.85	x	0.55	x	0.7	=	56.98	(77)
Southeast 0.9x	0.77	x	8.51	x	69.27	x	0.55	x	0.7	=	157.27	(77)
Southeast 0.9x	0.77	x	9.45	x	69.27	x	0.55	x	0.7	=	174.64	(77)
Southeast 0.9x	0.77	x	2.3	x	69.27	x	0.55	x	0.7	=	42.51	(77)
Southeast 0.9x	0.77	x	8.51	x	44.07	x	0.55	x	0.7	=	100.06	(77)
Southeast 0.9x	0.77	x	9.45	x	44.07	x	0.55	x	0.7	=	111.12	(77)
Southeast 0.9x	0.77	x	2.3	x	44.07	x	0.55	x	0.7	=	27.04	(77)
Southeast 0.9x	0.77	x	8.51	x	31.49	x	0.55	x	0.7	=	71.49	(77)
Southeast 0.9x	0.77	x	9.45	x	31.49	x	0.55	x	0.7	=	79.39	(77)
Southeast 0.9x	0.77	x	2.3	x	31.49	x	0.55	x	0.7	=	19.32	(77)
Southwest 0.9x	0.77	x	2.3	x	36.79		0.55	x	0.7	=	22.58	(79)
Southwest 0.9x	0.77	x	2.3	x	62.67		0.55	x	0.7	=	38.46	(79)
Southwest 0.9x	0.77	x	2.3	x	85.75		0.55	x	0.7	=	52.62	(79)
Southwest 0.9x	0.77	x	2.3	x	106.25		0.55	x	0.7	=	65.2	(79)
Southwest 0.9x	0.77	x	2.3	x	119.01		0.55	x	0.7	=	73.03	(79)
Southwest 0.9x	0.77	x	2.3	x	118.15		0.55	x	0.7	=	72.5	(79)
Southwest 0.9x	0.77	x	2.3	x	113.91		0.55	x	0.7	=	69.9	(79)
Southwest 0.9x	0.77	x	2.3	x	104.39		0.55	x	0.7	=	64.06	(79)
Southwest 0.9x	0.77	x	2.3	x	92.85		0.55	x	0.7	=	56.98	(79)
Southwest 0.9x	0.77	x	2.3	x	69.27		0.55	x	0.7	=	42.51	(79)
Southwest 0.9x	0.77	x	2.3	x	44.07		0.55	x	0.7	=	27.04	(79)
Southwest 0.9x	0.77	x	2.3	x	31.49		0.55	x	0.7	=	19.32	(79)
Northwest 0.9x	0.77	x	2.3	x	11.28	x	0.55	x	0.7	=	6.92	(81)
Northwest 0.9x	0.77	x	2.3	x	22.97	x	0.55	x	0.7	=	14.09	(81)
Northwest 0.9x	0.77	x	2.3	x	41.38	x	0.55	x	0.7	=	25.39	(81)
Northwest 0.9x	0.77	x	2.3	x	67.96	x	0.55	x	0.7	=	41.7	(81)
Northwest 0.9x	0.77	x	2.3	x	91.35	x	0.55	x	0.7	=	56.05	(81)
Northwest 0.9x	0.77	x	2.3	x	97.38	x	0.55	x	0.7	=	59.76	(81)
Northwest 0.9x	0.77	x	2.3	x	91.1	x	0.55	x	0.7	=	55.9	(81)
Northwest 0.9x	0.77	x	2.3	x	72.63	x	0.55	x	0.7	=	44.57	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	2.3	x	50.42	x	0.55	x	0.7	=	30.94	(81)
Northwest 0.9x	0.77	x	2.3	x	28.07	x	0.55	x	0.7	=	17.22	(81)
Northwest 0.9x	0.77	x	2.3	x	14.2	x	0.55	x	0.7	=	8.71	(81)
Northwest 0.9x	0.77	x	2.3	x	9.21	x	0.55	x	0.7	=	5.65	(81)

Solar gains in watts, calculated for each month

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

(83)m=	261.68	459.1	663.65	881.77	1041.94	1058.29	1010.36	887.22	738.61	516.98	315.87	222.37	(83)
--------	--------	-------	--------	--------	---------	---------	---------	--------	--------	--------	--------	--------	------

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

(84)m=	703.5	898.72	1087.78	1280.41	1414.1	1405.08	1341.22	1225.14	1090.21	894.3	722.37	651.01	(84)
--------	-------	--------	---------	---------	--------	---------	---------	---------	---------	-------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.95	0.85	0.67	0.47	0.34	0.39	0.64	0.92	0.99	1	(86)

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

(87)m=	19.95	20.19	20.49	20.8	20.95	20.99	21	21	20.97	20.73	20.27	19.91	(87)
--------	-------	-------	-------	------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.03	20.03	20.03	20.05	20.05	20.07	20.07	20.07	20.06	20.05	20.04	20.04	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.98	0.94	0.82	0.61	0.41	0.27	0.31	0.57	0.89	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	18.63	18.98	19.41	19.84	20.01	20.06	20.07	20.07	20.04	19.76	19.12	18.58	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.26

(91)

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

(92)m=	18.97	19.29	19.69	20.09	20.25	20.3	20.3	20.31	20.28	20.01	19.41	18.92	(92)
--------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------

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

(93)m=	18.82	19.14	19.54	19.94	20.1	20.15	20.15	20.16	20.13	19.86	19.26	18.77	(93)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.93	0.81	0.62	0.41	0.28	0.32	0.57	0.89	0.98	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	698.51	878.22	1014.13	1037.72	870.34	581.33	373.73	393.3	624.43	791.49	709.29	647.81	(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 x [(93)m – (96)m]

(97)m=	1597.53	1561.3	1425.29	1185.61	899.71	583.99	373.96	393.79	638.85	991.19	1311.1	1582	(97)
--------	---------	--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	------	------

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

(98)m=	668.87	459.03	305.9	106.48	21.85	0	0	0	0	148.58	433.3	695.03	(98)
--------	--------	--------	-------	--------	-------	---	---	---	---	--------	-------	--------	------

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

2839.05

(98)

Space heating requirement in kWh/m²/year

27.56

(99)

DER WorkSheet: New dwelling design stage

8c. Space cooling requirement

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

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

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	988.88	778.48	796.69	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	969.67	772.23	786.3	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	-------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1739.88	1663.22	1528.92	0	0	0	0	(103)
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Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	554.55	662.9	552.51	0	0	0	0	
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Total = Sum(104) = 1769.96 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.7 (105)

Intermittency factor (Table 10b)

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

Total = Sum(104) = 0 (106)

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

(107)m=	0	0	0	0	0	96.9	115.83	96.54	0	0	0	0	
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Total = Sum(107) = 309.28 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 3 (108)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0	(201)
---	-------

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1	(202)
---	-------

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1	(204)
---	-------

Efficiency of main space heating system 1

90.4	(206)
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Efficiency of secondary/supplementary heating system, %

0	(208)
---	-------

Cooling System Energy Efficiency Ratio

5.13	(209)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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kWh/year

Space heating requirement (calculated above)

668.87	459.03	305.9	106.48	21.85	0	0	0	0	148.58	433.3	695.03
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(211)m = {[(98)m x (204)] } x 100 ÷ (206)

(211)

739.9	507.78	338.39	117.79	24.17	0	0	0	0	164.36	479.31	768.84
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Total (kWh/year) = Sum(211)_{1...5,10, 12} = 3140.54 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
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Total (kWh/year) = Sum(215)_{1...5,10, 12} = 0 (215)

Water heating

Output from water heater (calculated above)

213.9	188.54	198.01	176.48	170.86	150.49	144.18	160.73	162.5	184.08	194.63	208.76
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Efficiency of water heater

80.3	(216)
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DER WorkSheet: New dwelling design stage

(217)m=

87.73	87.21	86.14	83.82	81.33	80.3	80.3	80.3	80.3	84.52	87.01	87.85
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 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

243.83	216.19	229.87	210.54	210.09	187.41	179.55	200.16	202.37	217.8	223.69	237.64
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

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

2559.11

 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

(221)m=

0	0	0	0	0	18.89	22.58	18.82	0	0	0	0
---	---	---	---	---	-------	-------	-------	---	---	---	---

Total = Sum(221)_{6...8} =

60.29

 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Space cooling fuel used

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

247.72

 (230a)

central heating pump:

30

 (230c)

Total electricity for the above, kWh/year

sum of (230a) (230g) =

277.72

 (231)

Electricity for lighting

411.09

 (232)

Electricity generated by PVs

-271.71

 (233)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	<div>0.216</div>	=	<div>678.36</div>	(261)
Space heating (secondary)	(215) x	<div>0.519</div>	=	<div>0</div>	(263)
Water heating	(219) x	<div>0.216</div>	=	<div>552.77</div>	(264)
Space and water heating	(261) + (262) + (263) + (264) =			<div>1231.12</div>	(265)
Space cooling	(221) x	<div>0.519</div>	=	<div>31.29</div>	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	<div>0.519</div>	=	<div>144.14</div>	(267)
Electricity for lighting	(232) x	<div>0.519</div>	=	<div>213.36</div>	(268)
Energy saving/generation technologies Item 1		<div>0.519</div>	=	<div>-141.02</div>	(269)
Total CO2, kg/year	sum of (265) (271) =			<div>1478.89</div>	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			<div>14.36</div>	(273)
El rating (section 14)				<div>87</div>	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.10

Property Address: Flat 04

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Basement	59.89 (1a) x	2.7 (2a) =	161.7 (3a)
Ground floor	46.65 (1b) x	3.27 (2b) =	152.55 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	106.54 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	314.25 (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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
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)
<i>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</i>		
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)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.15 (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

	0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18
--	------	------	------	------	------	------	------	------	------	------	------	------

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) =

73.95 (23c)

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

(24a)m=	0.32	0.32	0.31	0.3	0.29	0.27	0.27	0.27	0.28	0.29	0.3	0.31	(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=	0.32	0.32	0.31	0.3	0.29	0.27	0.27	0.27	0.28	0.29	0.3	0.31	(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			8.51	$x1/[1/(1.2)+0.04] =$	9.74		(27)
Windows Type 2			2.3	$x1/[1/(1.2)+0.04] =$	2.63		(27)
Windows Type 3			8.51	$x1/[1/(1.2)+0.04] =$	9.74		(27)
Windows Type 4			5.35	$x1/[1/(1.2)+0.04] =$	6.13		(27)
Floor			59.89	x 0.1 =	5.989		(28)
Walls Type1	11.62	0	11.62	x 0.16 =	1.86		(29)
Walls Type2	34.96	24.67	10.29	x 0.16 =	1.65		(29)
Walls Type3	62.35	0	62.35	x 0.16 =	9.98		(29)
Roof Type1	15.98	0	15.98	x 0.12 =	1.92		(30)
Roof Type2	16.48	0	16.48	x 0.12 =	1.98		(30)
Total area of elements, m²			201.27				(31)

* 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) = 51.61 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 20791.96 (34)

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

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

DER WorkSheet: New dwelling design stage

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

7.67 (36)

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

Total fabric heat loss

(33) + (36) =

59.28 (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=	33.34	32.95	32.56	30.62	30.23	28.28	28.28	27.9	29.06	30.23	31.01	31.78

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	92.62	92.23	91.84	89.9	89.51	87.56	87.56	87.17	88.34	89.51	90.28	91.06
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

Average = Sum(39)₁₋₁₂ / 12 =

89.8 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=	0.87	0.87	0.86	0.84	0.84	0.82	0.82	0.82	0.83	0.84	0.85	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

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

2.79

(42)

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

100.52

(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=	110.57	106.55	102.53	98.51	94.49	90.47	90.47	94.49	98.51	102.53	106.55	110.57
--------	--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	--------	--------

Total = Sum(44)₁₋₁₂ =

1206.23 (44)

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

(45)m=	163.97	143.41	147.99	129.02	123.8	106.83	98.99	113.59	114.95	133.96	146.23	158.8
--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	-------

Total = Sum(45)₁₋₁₂ =

1581.56 (45)

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

(46)m=	24.6	21.51	22.2	19.35	18.57	16.02	14.85	17.04	17.24	20.09	21.93	23.82
--------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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

0
0

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

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

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

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

(61)m=

50.96	46.03	50.96	48.58	48.15	44.61	46.1	48.15	48.58	50.96	49.32	50.96
-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------

(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=

214.93	189.44	198.95	177.6	171.95	151.44	145.09	161.74	163.53	184.92	195.55	209.76
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(62)

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

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

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

214.93	189.44	198.95	177.6	171.95	151.44	145.09	161.74	163.53	184.92	195.55	209.76
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(64)

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

2164.91

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=

67.26	59.19	61.95	55.04	53.2	46.67	44.44	49.81	50.37	57.28	60.95	65.54
-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

(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
139.62	139.62	139.62	139.62	139.62	139.62	139.62	139.62	139.62	139.62	139.62	139.62

(66)

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

(67)m=

23.76	21.1	17.16	12.99	9.71	8.2	8.86	11.52	15.46	19.62	22.91	24.42
-------	------	-------	-------	------	-----	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

266.49	269.25	262.28	247.45	228.72	211.12	199.36	196.6	203.57	218.4	237.13	254.73
--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------

(68)

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

(69)m=

36.96	36.96	36.96	36.96	36.96	36.96	36.96	36.96	36.96	36.96	36.96	36.96
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

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

(71)m=

-111.7	-111.7	-111.7	-111.7	-111.7	-111.7	-111.7	-111.7	-111.7	-111.7	-111.7	-111.7
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

90.4	88.08	83.26	76.45	71.51	64.82	59.73	66.95	69.95	76.99	84.65	88.09
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

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

(73)m=

448.54	446.32	430.59	404.78	377.83	352.03	335.84	342.95	356.86	382.91	412.57	435.13
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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)	
Southeast 0.9x	0.77	x	8.51	x	36.79	x	0.55	x	0.7	=	83.54	(77)
Southeast 0.9x	0.77	x	8.51	x	36.79	x	0.55	x	0.7	=	83.54	(77)
Southeast 0.9x	0.77	x	5.35	x	36.79	x	0.55	x	0.7	=	52.52	(77)
Southeast 0.9x	0.77	x	8.51	x	62.67	x	0.55	x	0.7	=	142.3	(77)
Southeast 0.9x	0.77	x	8.51	x	62.67	x	0.55	x	0.7	=	142.3	(77)
Southeast 0.9x	0.77	x	5.35	x	62.67	x	0.55	x	0.7	=	89.46	(77)
Southeast 0.9x	0.77	x	8.51	x	85.75	x	0.55	x	0.7	=	194.7	(77)
Southeast 0.9x	0.77	x	8.51	x	85.75	x	0.55	x	0.7	=	194.7	(77)
Southeast 0.9x	0.77	x	5.35	x	85.75	x	0.55	x	0.7	=	122.4	(77)
Southeast 0.9x	0.77	x	8.51	x	106.25	x	0.55	x	0.7	=	241.25	(77)
Southeast 0.9x	0.77	x	8.51	x	106.25	x	0.55	x	0.7	=	241.25	(77)
Southeast 0.9x	0.77	x	5.35	x	106.25	x	0.55	x	0.7	=	151.66	(77)
Southeast 0.9x	0.77	x	8.51	x	119.01	x	0.55	x	0.7	=	270.21	(77)
Southeast 0.9x	0.77	x	8.51	x	119.01	x	0.55	x	0.7	=	270.21	(77)
Southeast 0.9x	0.77	x	5.35	x	119.01	x	0.55	x	0.7	=	169.88	(77)
Southeast 0.9x	0.77	x	8.51	x	118.15	x	0.55	x	0.7	=	268.26	(77)
Southeast 0.9x	0.77	x	8.51	x	118.15	x	0.55	x	0.7	=	268.26	(77)
Southeast 0.9x	0.77	x	5.35	x	118.15	x	0.55	x	0.7	=	168.65	(77)
Southeast 0.9x	0.77	x	8.51	x	113.91	x	0.55	x	0.7	=	258.63	(77)
Southeast 0.9x	0.77	x	8.51	x	113.91	x	0.55	x	0.7	=	258.63	(77)
Southeast 0.9x	0.77	x	5.35	x	113.91	x	0.55	x	0.7	=	162.59	(77)
Southeast 0.9x	0.77	x	8.51	x	104.39	x	0.55	x	0.7	=	237.02	(77)
Southeast 0.9x	0.77	x	8.51	x	104.39	x	0.55	x	0.7	=	237.02	(77)
Southeast 0.9x	0.77	x	5.35	x	104.39	x	0.55	x	0.7	=	149.01	(77)
Southeast 0.9x	0.77	x	8.51	x	92.85	x	0.55	x	0.7	=	210.82	(77)
Southeast 0.9x	0.77	x	8.51	x	92.85	x	0.55	x	0.7	=	210.82	(77)
Southeast 0.9x	0.77	x	5.35	x	92.85	x	0.55	x	0.7	=	132.54	(77)
Southeast 0.9x	0.77	x	8.51	x	69.27	x	0.55	x	0.7	=	157.27	(77)
Southeast 0.9x	0.77	x	8.51	x	69.27	x	0.55	x	0.7	=	157.27	(77)
Southeast 0.9x	0.77	x	5.35	x	69.27	x	0.55	x	0.7	=	98.87	(77)
Southeast 0.9x	0.77	x	8.51	x	44.07	x	0.55	x	0.7	=	100.06	(77)
Southeast 0.9x	0.77	x	8.51	x	44.07	x	0.55	x	0.7	=	100.06	(77)
Southeast 0.9x	0.77	x	5.35	x	44.07	x	0.55	x	0.7	=	62.91	(77)
Southeast 0.9x	0.77	x	8.51	x	31.49	x	0.55	x	0.7	=	71.49	(77)
Southeast 0.9x	0.77	x	8.51	x	31.49	x	0.55	x	0.7	=	71.49	(77)
Southeast 0.9x	0.77	x	5.35	x	31.49	x	0.55	x	0.7	=	44.95	(77)
Southwest 0.9x	0.77	x	2.3	x	36.79		0.55	x	0.7	=	22.58	(79)
Southwest 0.9x	0.77	x	2.3	x	62.67		0.55	x	0.7	=	38.46	(79)
Southwest 0.9x	0.77	x	2.3	x	85.75		0.55	x	0.7	=	52.62	(79)

DER WorkSheet: New dwelling design stage

Southwest0.9x	0.77	x	2.3	x	106.25	0.55	x	0.7	=	65.2	(79)
Southwest0.9x	0.77	x	2.3	x	119.01	0.55	x	0.7	=	73.03	(79)
Southwest0.9x	0.77	x	2.3	x	118.15	0.55	x	0.7	=	72.5	(79)
Southwest0.9x	0.77	x	2.3	x	113.91	0.55	x	0.7	=	69.9	(79)
Southwest0.9x	0.77	x	2.3	x	104.39	0.55	x	0.7	=	64.06	(79)
Southwest0.9x	0.77	x	2.3	x	92.85	0.55	x	0.7	=	56.98	(79)
Southwest0.9x	0.77	x	2.3	x	69.27	0.55	x	0.7	=	42.51	(79)
Southwest0.9x	0.77	x	2.3	x	44.07	0.55	x	0.7	=	27.04	(79)
Southwest0.9x	0.77	x	2.3	x	31.49	0.55	x	0.7	=	19.32	(79)

Solar gains in watts, calculated for each month

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

(83)m=	242.18	412.52	564.43	699.36	783.34	777.67	749.76	687.11	611.16	455.92	290.08	207.26	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	690.72	858.84	995.02	1104.13	1161.16	1129.7	1085.6	1030.05	968.02	838.83	702.65	642.38	(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	0.96	0.86	0.69	0.49	0.35	0.39	0.62	0.91	0.99	1	(86)

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

(87)m=	20.2	20.41	20.65	20.87	20.97	21	21	21	20.99	20.84	20.48	20.17	(87)
--------	------	-------	-------	-------	-------	----	----	----	-------	-------	-------	-------	------

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

(88)m=	20.19	20.2	20.2	20.22	20.22	20.23	20.23	20.24	20.23	20.22	20.21	20.21	(88)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.98	0.94	0.83	0.64	0.44	0.29	0.32	0.55	0.88	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	19.13	19.43	19.76	20.08	20.19	20.23	20.23	20.24	20.22	20.05	19.54	19.09	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.25 (91)

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

(92)m=	19.39	19.67	19.98	20.27	20.39	20.42	20.42	20.43	20.41	20.25	19.77	19.36	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.24	19.52	19.83	20.12	20.24	20.27	20.27	20.28	20.26	20.1	19.62	19.21	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.82	0.64	0.44	0.3	0.33	0.56	0.87	0.98	1	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	---	------

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

(95)m=	686.43	840.38	931.58	910.2	746.31	495.57	321.72	337.85	538.93	731.87	690	639.69	(95)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	-----	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1384.12	1348.36	1224.55	1008.94	764.23	496.76	321.79	337.99	544.38	849.94	1130.77	1366.88	(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=	519.08	341.37	217.97	71.09	13.34	0	0	0	0	87.84	317.35	541.03	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2109.08 (98)

Space heating requirement in kWh/m²/year

19.8 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	823.09	647.96	662.52	0	0	0	0	(100)

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.99	1	0.99	0	0	0	0	(101)
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Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	813.64	645.54	658.89	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1419.79	1366.17	1302.67	0	0	0	0	(103)
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Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$

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

(104)m=	0	0	0	0	0	436.43	536.16	478.97	0	0	0	0	
Total = Sum(104) =													1451.56 (104)
Cooled fraction	f C = cooled area ÷ (4) =												0.7 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104) =													0 (106)

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

(107)m=	0	0	0	0	0	76.3	93.73	83.73	0	0	0	0	
Total = Sum(107) =													253.76 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) =	2.38 (108)
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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0 (201)
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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
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Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
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Efficiency of main space heating system 1	90.4 (206)
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Efficiency of secondary/supplementary heating system, %	0 (208)
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Cooling System Energy Efficiency Ratio	5.13 (209)
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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement (calculated above)	519.08	341.37	217.97	71.09	13.34	0	0	0	0	87.84	317.35	541.03	

(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
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(211)m =	574.21	377.62	241.12	78.64	14.75	0	0	0	0	97.17	351.05	598.49	
Total (kWh/year) = Sum(211) _{1...5,10...12} =													2333.06 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1...5,10...12} =													0 (215)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

214.93	189.44	198.95	177.6	171.95	151.44	145.09	161.74	163.53	184.92	195.55	209.76
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Efficiency of water heater

80.3 (216)

(217)m= 87.19 86.52 85.28 82.95 80.95 80.3 80.3 80.3 80.3 83.3 86.26 87.33 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

246.51	218.96	233.28	214.11	212.41	188.6	180.69	201.43	203.65	222.01	226.69	240.19
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Total = Sum(219a)_{1..12} = 2588.52 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	14.87	18.27	16.32	0	0	0	0
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Total = Sum(221)_{6..8} = 49.47 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year
2333.06

Water heating fuel used

2588.52

Space cooling fuel used

49.47

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

258.78 (230a)

central heating pump:

30 (230c)

Total electricity for the above, kWh/year

sum of (230a) (230g) = 288.78 (231)

Electricity for lighting

419.57 (232)

Electricity generated by PVs

-271.71 (233)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	503.94	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	559.12	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1063.06	(265)
Space cooling	(221) x	0.519	=	25.67	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	149.88	(267)
Electricity for lighting	(232) x	0.519	=	217.76	(268)
Energy saving/generation technologies Item 1		0.519	=	-141.02	(269)
Total CO2, kg/year		sum of (265) (271) =		1315.35	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		12.35	(273)
EI rating (section 14)				88	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.10

Property Address: Flat 05

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Basement	<input type="text" value="71.92"/> (1a) x	<input type="text" value="2.5"/> (2a) =	<input type="text" value="179.81"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="71.92"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="179.81"/> (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	<input type="text" value="0"/> +	<input type="text" value="0"/> +	<input type="text" value="0"/> =	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> +	<input type="text" value="0"/> +	<input type="text" value="0"/> =	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7a)
Number of passive vents				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires				<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="0"/> ÷ (5) =	<input type="text" value="0"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		<input type="text" value="0"/> (9)
Additional infiltration	[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>		<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0		<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped		<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		<input type="text" value="3"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		<input type="text" value="0.15"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		<input type="text" value="0"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	<input type="text" value="1"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	<input type="text" value="0.15"/> (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

0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18
------	------	------	------	------	------	------	------	------	------	------	------

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) =

73.95 (23c)

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

(24a)m= 0.32 0.32 0.31 0.3 0.29 0.27 0.27 0.27 0.28 0.29 0.3 0.31 (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= 0.32 0.32 0.31 0.3 0.29 0.27 0.27 0.27 0.28 0.29 0.3 0.31 (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			17.75	$\times 1/[1/(1.2) + 0.04] =$	20.32		(27)
Windows Type 2			4.65	$\times 1/[1/(1.2) + 0.04] =$	5.32		(27)
Windows Type 3			4.65	$\times 1/[1/(1.2) + 0.04] =$	5.32		(27)
Walls Type1	68.66	27.05	41.61	$\times 0.16 =$	6.66		(29)
Walls Type2	17.76	0	17.76	$\times 0.16 =$	2.84		(29)
Total area of elements, m²			86.42				(31)

* 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) = 40.47 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 11280.49 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 12.41 (36)

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

Total fabric heat loss (33) + (36) = 52.88 (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=	19.08	18.85	18.63	17.52	17.3	16.18	16.18	15.96	16.63	17.3	17.74	18.19

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

(39)m= 71.96 71.74 71.51 70.4 70.18 69.07 69.07 68.84 69.51 70.18 70.62 71.07
Average = Sum(39)₁₋₁₂ /12= 70.34 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99		
Average = Sum(40) ₁₋₁₂ / 12 =													0.98	(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

2.29

(42)

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

if TFA ≤ 13.9, N = 1

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

88.63

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

(44)m=	97.5	93.95	90.41	86.86	83.31	79.77	79.77	83.31	86.86	90.41	93.95	97.5		
Total = Sum(44) ₁₋₁₂ =													1063.6	(44)

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

(45)m=	144.58	126.45	130.49	113.76	109.16	94.2	87.29	100.16	101.36	118.12	128.94	140.02		
Total = Sum(45) ₁₋₁₂ =													1394.54	(45)

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

(46)m=	21.69	18.97	19.57	17.06	16.37	14.13	13.09	15.02	15.2	17.72	19.34	21		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	----	--	------

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

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

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

DER WorkSheet: New dwelling design stage

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

(61)m=	49.68	43.24	46.07	42.84	42.46	39.34	40.65	42.46	42.84	46.07	46.33	49.68	(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=	194.27	169.7	176.56	156.6	151.62	133.53	127.94	142.62	144.19	164.19	175.27	189.71	(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=	194.27	169.7	176.56	156.6	151.62	133.53	127.94	142.62	144.19	164.19	175.27	189.71	
Output from water heater (annual) _{1 12}												1926.19	(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=	60.49	52.86	54.91	48.54	46.91	41.15	39.19	43.92	44.41	50.79	54.46	58.98	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	(66)

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

(67)m=	17.99	15.97	12.99	9.84	7.35	6.21	6.71	8.72	11.7	14.86	17.34	18.49	(67)
--------	-------	-------	-------	------	------	------	------	------	------	-------	-------	-------	------

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

(68)m=	201.75	203.84	198.56	187.33	173.16	159.83	150.93	148.84	154.11	165.34	179.52	192.84	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	-91.68	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	81.31	78.66	73.8	67.41	63.05	57.16	52.67	59.03	61.68	68.27	75.63	79.27	(72)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	361.42	358.85	345.73	324.96	303.94	283.58	270.68	276.96	287.87	308.85	332.87	350.98	(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 ₁ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	4.65	x	11.28	x	0.55	x	0.7	=	14	(75)
Northeast 0.9x	0.77	x	4.65	x	22.97	x	0.55	x	0.7	=	28.49	(75)
Northeast 0.9x	0.77	x	4.65	x	41.38	x	0.55	x	0.7	=	51.34	(75)
Northeast 0.9x	0.77	x	4.65	x	67.96	x	0.55	x	0.7	=	84.31	(75)
Northeast 0.9x	0.77	x	4.65	x	91.35	x	0.55	x	0.7	=	113.33	(75)

DER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	4.65	x	97.38	x	0.55	x	0.7	=	120.82	(75)
Northeast 0.9x	0.77	x	4.65	x	91.1	x	0.55	x	0.7	=	113.02	(75)
Northeast 0.9x	0.77	x	4.65	x	72.63	x	0.55	x	0.7	=	90.1	(75)
Northeast 0.9x	0.77	x	4.65	x	50.42	x	0.55	x	0.7	=	62.55	(75)
Northeast 0.9x	0.77	x	4.65	x	28.07	x	0.55	x	0.7	=	34.82	(75)
Northeast 0.9x	0.77	x	4.65	x	14.2	x	0.55	x	0.7	=	17.61	(75)
Northeast 0.9x	0.77	x	4.65	x	9.21	x	0.55	x	0.7	=	11.43	(75)
Southeast 0.9x	0.77	x	17.75	x	36.79	x	0.55	x	0.7	=	174.25	(77)
Southeast 0.9x	0.77	x	17.75	x	62.67	x	0.55	x	0.7	=	296.81	(77)
Southeast 0.9x	0.77	x	17.75	x	85.75	x	0.55	x	0.7	=	406.11	(77)
Southeast 0.9x	0.77	x	17.75	x	106.25	x	0.55	x	0.7	=	503.19	(77)
Southeast 0.9x	0.77	x	17.75	x	119.01	x	0.55	x	0.7	=	563.61	(77)
Southeast 0.9x	0.77	x	17.75	x	118.15	x	0.55	x	0.7	=	559.53	(77)
Southeast 0.9x	0.77	x	17.75	x	113.91	x	0.55	x	0.7	=	539.45	(77)
Southeast 0.9x	0.77	x	17.75	x	104.39	x	0.55	x	0.7	=	494.37	(77)
Southeast 0.9x	0.77	x	17.75	x	92.85	x	0.55	x	0.7	=	439.73	(77)
Southeast 0.9x	0.77	x	17.75	x	69.27	x	0.55	x	0.7	=	328.04	(77)
Southeast 0.9x	0.77	x	17.75	x	44.07	x	0.55	x	0.7	=	208.71	(77)
Southeast 0.9x	0.77	x	17.75	x	31.49	x	0.55	x	0.7	=	149.12	(77)
Southwest 0.9x	0.77	x	4.65	x	36.79		0.55	x	0.7	=	45.65	(79)
Southwest 0.9x	0.77	x	4.65	x	62.67		0.55	x	0.7	=	77.76	(79)
Southwest 0.9x	0.77	x	4.65	x	85.75		0.55	x	0.7	=	106.39	(79)
Southwest 0.9x	0.77	x	4.65	x	106.25		0.55	x	0.7	=	131.82	(79)
Southwest 0.9x	0.77	x	4.65	x	119.01		0.55	x	0.7	=	147.65	(79)
Southwest 0.9x	0.77	x	4.65	x	118.15		0.55	x	0.7	=	146.58	(79)
Southwest 0.9x	0.77	x	4.65	x	113.91		0.55	x	0.7	=	141.32	(79)
Southwest 0.9x	0.77	x	4.65	x	104.39		0.55	x	0.7	=	129.51	(79)
Southwest 0.9x	0.77	x	4.65	x	92.85		0.55	x	0.7	=	115.2	(79)
Southwest 0.9x	0.77	x	4.65	x	69.27		0.55	x	0.7	=	85.94	(79)
Southwest 0.9x	0.77	x	4.65	x	44.07		0.55	x	0.7	=	54.68	(79)
Southwest 0.9x	0.77	x	4.65	x	31.49		0.55	x	0.7	=	39.07	(79)

Solar gains in watts, calculated for each month

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

(83)m= 233.89 403.06 563.83 719.31 824.59 826.93 793.79 713.99 617.48 448.79 281 199.62 (83)

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

(84)m= 595.31 761.91 909.56 1044.27 1128.52 1110.51 1064.48 990.95 905.35 757.64 613.87 550.6 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.99	0.97	0.9	0.75	0.57	0.4	0.29	0.32	0.52	0.84	0.97	0.99

(86)

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

(87)m= 20.18 20.44 20.71 20.91 20.98 21 21 21 20.99 20.87 20.48 20.13 (87)

DER WorkSheet: New dwelling design stage

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

(88)m=	20.08	20.09	20.09	20.1	20.1	20.12	20.12	20.12	20.11	20.1	20.1	20.09	(88)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	------	-------	------

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

(89)m=	0.99	0.96	0.88	0.71	0.52	0.34	0.23	0.26	0.46	0.79	0.96	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	19.01	19.38	19.74	20.01	20.09	20.12	20.12	20.12	20.11	19.97	19.46	18.94	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.42	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.82	20.15	20.39	20.46	20.48	20.49	20.49	20.48	20.35	19.88	19.44	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.35	19.67	20	20.24	20.31	20.33	20.34	20.34	20.33	20.2	19.73	19.29	(93)
--------	-------	-------	----	-------	-------	-------	-------	-------	-------	------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.95	0.87	0.72	0.53	0.36	0.24	0.27	0.47	0.8	0.96	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	-----	------	------	------

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

(95)m=	585.88	724.39	794.74	749.92	596.57	395.41	257.94	270.92	429.63	604.09	589.28	544.47	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1082.64	1059.43	965.14	798.15	604.46	396.04	257.99	271.02	432.79	673.49	892.27	1072.32	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	369.59	225.15	126.77	34.72	5.87	0	0	0	0	51.64	218.16	392.72	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												1424.61	(98)

Space heating requirement in kWh/m²/year

19.81	(99)
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8c. Space cooling requirement

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

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

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	649.22	511.08	523.21	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.99	1	1	0	0	0	0	(101)
---------	---	---	---	---	---	------	---	---	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	644.84	509.83	521.19	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1374.66	1319.4	1234.38	0	0	0	0	(103)
---------	---	---	---	---	---	---------	--------	---------	---	---	---	---	-------

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

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

(104)m=	0	0	0	0	0	525.47	602.32	530.61	0	0	0	0	
Total = Sum(104) =												1658.4	(104)

Cooled fraction

f C = cooled area ÷ (4) =	0.7	(105)
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Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
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Total = Sum(104) =	0	(106)
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DER WorkSheet: New dwelling design stage

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

(107)m=	0	0	0	0	0	91.32	104.68	92.22	0	0	0	0	
Total = Sum(107) =													288.22 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 4.01 (108)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.13 (209)

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

Space heating requirement (calculated above)

369.59	225.15	126.77	34.72	5.87	0	0	0	0	51.64	218.16	392.72	
(211)m = {[(98)m × (204)] } × 100 ÷ (206) 408.84 249.05 140.24 38.41 6.49 0 0 0 0 57.12 241.32 434.42 (211)												
Total (kWh/year) = Sum(211) _{1..5,10..12} = 1575.9 (211)												

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10..12} = 0 (215)													

Water heating

Output from water heater (calculated above)

194.27	169.7	176.56	156.6	151.62	133.53	127.94	142.62	144.19	164.19	175.27	189.71	
Efficiency of water heater 80.3 (216)												
(217)m=	86.65	85.76	84.23	81.96	80.64	80.3	80.3	80.3	80.3	82.51	85.6	86.84 (217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=	224.21	197.87	209.61	191.06	188.03	166.29	159.32	177.61	179.57	199.01	204.75	218.45	
Total = Sum(219a) _{1..12} = 2315.77 (219)													

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

(221)m=	0	0	0	0	0	17.8	20.41	17.98	0	0	0	0	
Total = Sum(221) _{6..8} = 56.18 (221)													

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		1575.9
Water heating fuel used		2315.77
Space cooling fuel used		56.18

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside 148.07 (230a)

central heating pump: 30 (230c)

DER WorkSheet: New dwelling design stage

Total electricity for the above, kWh/year	sum of (230a) (230g) =	178.07	(231)
Electricity for lighting		317.63	(232)
Electricity generated by PVs		-271.71	(233)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	340.39	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	500.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =			840.6	(265)
Space cooling	(221) x	0.519	=	29.16	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	92.42	(267)
Electricity for lighting	(232) x	0.519	=	164.85	(268)
Energy saving/generation technologies Item 1		0.519	=	-141.02	(269)
Total CO2, kg/year		sum of (265) (271) =		986.02	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		13.71	(273)
El rating (section 14)				89	(274)