

18th August 2021

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Sustainable Homes for
a Sustainable Future

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Re. Construction of two new houses at 5 Grass Hill, Reading. Planning Ref: 201233

Dear John

I have completed the preliminary SAP 2012 calculations to confirm compliance with 2013 Building Regulations L1A, and demonstrate that the dwellings as proposed, will achieve a 19% improvement in the dwelling emission rate (DER) over the target emission rate (TER).

Copies of the SAP DER and TER worksheets are appended to this letter and show that the use of air source heat pumps to provide space heating and hot water, will achieve improvements to the DER in excess of 50% as follows:

Plot	TER	DER	% improvement of DER
1	24.73	11.94	51.7
2	25.28	12.15	51.9

The DER improvements far exceed the requirements of Reading Borough Council Local Plan Policy H5.

In addition, a copy of the Design Stage water efficiency calculation report is also appended. This shows that the dwellings will comply with the higher water efficiency standard under Regulations 36(3) of the Building Regulations Part G and Reading Borough Council Local Plan Policy H5.

Yours sincerely

Antony Straszewski

Domestic On Construction Energy Assessor (DOCEA)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Antony Straszewski	Stroma Number:	STRO006494
Software Name:	Stroma FSAP 2012	Software Version:	Version: 1.0.5.41

Property Address: Plot 1

Address : 1

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	98.89	(1a) x	2.4	(2a) =	237.34
First floor	94.82	(1b) x	2.75	(2b) =	260.75
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	193.71	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	498.09
					(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							4	x 10 =	40
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.08	(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			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.33	(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) =		0.33	(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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TER 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

	0.42	0.41	0.4	0.36	0.36	0.31	0.31	0.31	0.33	0.36	0.37	0.39
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(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
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(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
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(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=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58
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(24d)

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

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58
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(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			4.08	x 1	= 4.08		(26)
Windows Type 1			4.72	x 1/[1/(1.4)+ 0.04] =	6.26		(27)
Windows Type 2			0.98	x 1/[1/(1.4)+ 0.04] =	1.3		(27)
Windows Type 3			1.27	x 1/[1/(1.4)+ 0.04] =	1.68		(27)
Windows Type 4			5.23	x 1/[1/(1.4)+ 0.04] =	6.93		(27)
Windows Type 5			0.73	x 1/[1/(1.4)+ 0.04] =	0.97		(27)
Windows Type 6			1.77	x 1/[1/(1.4)+ 0.04] =	2.35		(27)
Windows Type 7			0.72	x 1/[1/(1.4)+ 0.04] =	0.95		(27)
Windows Type 8			1.65	x 1/[1/(1.4)+ 0.04] =	2.19		(27)
Windows Type 9			0.89	x 1/[1/(1.4)+ 0.04] =	1.18		(27)
Windows Type 10			1.18	x 1/[1/(1.4)+ 0.04] =	1.56		(27)
Windows Type 11			3.78	x 1/[1/(1.4)+ 0.04] =	5.01		(27)
Windows Type 12			5.22	x 1/[1/(1.4)+ 0.04] =	6.92		(27)
Windows Type 13			1.58	x 1/[1/(1.4)+ 0.04] =	2.09		(27)
Windows Type 14			0.81	x 1/[1/(1.4)+ 0.04] =	1.07		(27)
Windows Type 15			0.73	x 1/[1/(1.4)+ 0.04] =	0.97		(27)
Windows Type 16			0.67	x 1/[1/(1.4)+ 0.04] =	0.89		(27)

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Windows Type 17			0.64	$\times 1/[1/(1.4) + 0.04] =$	0.85			(27)
Windows Type 18			0.69	$\times 1/[1/(1.4) + 0.04] =$	0.91			(27)
Windows Type 19			0.69	$\times 1/[1/(1.4) + 0.04] =$	0.91			(27)
Windows Type 20			1.21	$\times 1/[1/(1.4) + 0.04] =$	1.6			(27)
Windows Type 21			1.64	$\times 1/[1/(1.4) + 0.04] =$	2.17			(27)
Rooflights Type 1			1.295662	$\times 1/[1/(1.7) + 0.04] =$	2.202626			(27b)
Rooflights Type 2			0.5784206	$\times 1/[1/(1.7) + 0.04] =$	0.983315			(27b)
Rooflights Type 3			1.295662	$\times 1/[1/(1.7) + 0.04] =$	2.202626			(27b)
Floor Type 1			98.89	$\times$	0.13	$=$	12.8557	(28)
Floor Type 2			8.96	$\times$	0.13	$=$	1.1648	(28)
Walls Type1	114.26	23.22	91.04	$\times$	0.18	$=$	16.39	(29)
Walls Type2	113.49	20.8	92.69	$\times$	0.18	$=$	16.68	(29)
Walls Type3	5.94	0.64	5.3	$\times$	0.18	$=$	0.95	(29)
Roof Type1	7.85	0	7.85	$\times$	0.13	$=$	1.02	(30)
Roof Type2	99.42	3.75	95.67	$\times$	0.13	$=$	12.44	(30)
Total area of elements, m ²			448.81					(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) =	125.35	(33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	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		34.89	(36)
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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	160.24	(37)
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Ventilation heat loss calculated monthly	(38)m = 0.33 x (25)m x (5)		
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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	96.76	96.2	95.64	93.03	92.55	90.28	90.28	89.86	91.15	92.55	93.53	94.56	(38)

Heat transfer coefficient, W/K	(39)m = (37) + (38)m		
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(39)m=	257	256.43	255.88	253.27	252.79	250.52	250.52	250.1	251.39	252.79	253.77	254.8	
	Average = Sum(39) _{1...12} /12=											253.27	(39)

Heat loss parameter (HLP), W/m ² K	(40)m = (39)m ÷ (4)		
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(40)m=	1.33	1.32	1.32	1.31	1.3	1.29	1.29	1.29	1.3	1.3	1.31	1.32	
	Average = Sum(40) _{1...12} /12=											1.31	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N	2.99	(42)
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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	105.3	(43)
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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)

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

(45)m=	171.77	150.23	155.03	135.16	129.69	111.91	103.7	119	120.42	140.34	153.19	166.35		
Total = Sum(45) _{1...12} =													1656.8	(45)

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

(46)m=	25.77	22.54	23.25	20.27	19.45	16.79	15.56	17.85	18.06	21.05	22.98	24.95	
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	150	(47)
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If community heating and no tank in dwelling, enter 110 litres in (47)

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):	1.7	(48)
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Temperature factor from Table 2b	0.54	(49)
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Energy lost from water storage, kWh/year	(48) x (49) =	0.92	(50)
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b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
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If community heating see section 4.3

Volume factor from Table 2a	0	(52)
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Temperature factor from Table 2b	0	(53)
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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
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Enter (50) or (54) in (55)	0.92	(55)
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Water storage loss calculated for each month ((56)m = (55) x (41)m)

(56)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	
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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=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	
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Primary circuit loss (annual) from Table 3	0	(58)
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Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

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

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	
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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=	223.52	196.97	206.78	185.24	181.43	161.99	155.45	170.75	170.5	192.08	203.27	218.1	
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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	
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Output from water heater

(64)m=	223.52	196.97	206.78	185.24	181.43	161.99	155.45	170.75	170.5	192.08	203.27	218.1		
Output from water heater (annual) _{1...12}													2266.07	(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=	98.51	87.34	92.94	85	84.52	77.27	75.88	80.96	80.1	88.06	91	96.71	
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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
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(66)m=

149.69	149.69	149.69	149.69	149.69	149.69	149.69	149.69	149.69	149.69	149.69	149.69
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 (66)

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

(67)m=

32.54	28.9	23.51	17.8	13.3	11.23	12.14	15.77	21.17	26.88	31.37	33.45
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 (67)

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

(68)m=

365.03	368.82	359.27	338.95	313.3	289.19	273.08	269.3	278.84	299.16	324.81	348.92
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 (68)

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

(69)m=

37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97
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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=

-119.75	-119.75	-119.75	-119.75	-119.75	-119.75	-119.75	-119.75	-119.75	-119.75	-119.75	-119.75
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 (71)

Water heating gains (Table 5)

(72)m=

132.41	129.98	124.93	118.06	113.6	107.32	101.99	108.82	111.25	118.36	126.39	129.99
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 (72)

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

(73)m=

600.88	598.6	578.61	545.71	511.11	478.65	458.11	464.8	482.17	515.31	553.48	583.26
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 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.65</td></tr></table>	1.65	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>5.69</td></tr></table>	5.69	(75)
0.77																			
1.65																			
11.28																			
0.63																			
0.7																			
5.69																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>2.21</td></tr></table>	2.21	(75)
0.77																			
0.64																			
11.28																			
0.63																			
0.7																			
2.21																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.69</td></tr></table>	0.69	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>2.38</td></tr></table>	2.38	(75)
0.77																			
0.69																			
11.28																			
0.63																			
0.7																			
2.38																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.64</td></tr></table>	1.64	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>5.66</td></tr></table>	5.66	(75)
0.77																			
1.64																			
11.28																			
0.63																			
0.7																			
5.66																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.65</td></tr></table>	1.65	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>11.58</td></tr></table>	11.58	(75)
0.77																			
1.65																			
22.97																			
0.63																			
0.7																			
11.58																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>4.49</td></tr></table>	4.49	(75)
0.77																			
0.64																			
22.97																			
0.63																			
0.7																			
4.49																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.69</td></tr></table>	0.69	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>4.84</td></tr></table>	4.84	(75)
0.77																			
0.69																			
22.97																			
0.63																			
0.7																			
4.84																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.64</td></tr></table>	1.64	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>11.51</td></tr></table>	11.51	(75)
0.77																			
1.64																			
22.97																			
0.63																			
0.7																			
11.51																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.65</td></tr></table>	1.65	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>20.87</td></tr></table>	20.87	(75)
0.77																			
1.65																			
41.38																			
0.63																			
0.7																			
20.87																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>8.09</td></tr></table>	8.09	(75)
0.77																			
0.64																			
41.38																			
0.63																			
0.7																			
8.09																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.69</td></tr></table>	0.69	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>8.73</td></tr></table>	8.73	(75)
0.77																			
0.69																			
41.38																			
0.63																			
0.7																			
8.73																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.64</td></tr></table>	1.64	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>20.74</td></tr></table>	20.74	(75)
0.77																			
1.64																			
41.38																			
0.63																			
0.7																			
20.74																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.65</td></tr></table>	1.65	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>34.27</td></tr></table>	34.27	(75)
0.77																			
1.65																			
67.96																			
0.63																			
0.7																			
34.27																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>13.29</td></tr></table>	13.29	(75)
0.77																			
0.64																			
67.96																			
0.63																			
0.7																			
13.29																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.69</td></tr></table>	0.69	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>14.33</td></tr></table>	14.33	(75)
0.77																			
0.69																			
67.96																			
0.63																			
0.7																			
14.33																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.64</td></tr></table>	1.64	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>34.06</td></tr></table>	34.06	(75)
0.77																			
1.64																			
67.96																			
0.63																			
0.7																			
34.06																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.65</td></tr></table>	1.65	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>46.06</td></tr></table>	46.06	(75)
0.77																			
1.65																			
91.35																			
0.63																			
0.7																			
46.06																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>17.87</td></tr></table>	17.87	(75)
0.77																			
0.64																			
91.35																			
0.63																			
0.7																			
17.87																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.69</td></tr></table>	0.69	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>19.26</td></tr></table>	19.26	(75)
0.77																			
0.69																			
91.35																			
0.63																			
0.7																			
19.26																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.64</td></tr></table>	1.64	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>45.78</td></tr></table>	45.78	(75)
0.77																			
1.64																			
91.35																			
0.63																			
0.7																			
45.78																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.65</td></tr></table>	1.65	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>49.11</td></tr></table>	49.11	(75)
0.77																			
1.65																			
97.38																			
0.63																			
0.7																			
49.11																			

TER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	0.64	x	97.38	x	0.63	x	0.7	=	19.05	(75)
Northeast 0.9x	0.77	x	0.69	x	97.38	x	0.63	x	0.7	=	20.54	(75)
Northeast 0.9x	0.77	x	1.64	x	97.38	x	0.63	x	0.7	=	48.81	(75)
Northeast 0.9x	0.77	x	1.65	x	91.1	x	0.63	x	0.7	=	45.94	(75)
Northeast 0.9x	0.77	x	0.64	x	91.1	x	0.63	x	0.7	=	17.82	(75)
Northeast 0.9x	0.77	x	0.69	x	91.1	x	0.63	x	0.7	=	19.21	(75)
Northeast 0.9x	0.77	x	1.64	x	91.1	x	0.63	x	0.7	=	45.66	(75)
Northeast 0.9x	0.77	x	1.65	x	72.63	x	0.63	x	0.7	=	36.62	(75)
Northeast 0.9x	0.77	x	0.64	x	72.63	x	0.63	x	0.7	=	14.21	(75)
Northeast 0.9x	0.77	x	0.69	x	72.63	x	0.63	x	0.7	=	15.32	(75)
Northeast 0.9x	0.77	x	1.64	x	72.63	x	0.63	x	0.7	=	36.4	(75)
Northeast 0.9x	0.77	x	1.65	x	50.42	x	0.63	x	0.7	=	25.43	(75)
Northeast 0.9x	0.77	x	0.64	x	50.42	x	0.63	x	0.7	=	9.86	(75)
Northeast 0.9x	0.77	x	0.69	x	50.42	x	0.63	x	0.7	=	10.63	(75)
Northeast 0.9x	0.77	x	1.64	x	50.42	x	0.63	x	0.7	=	25.27	(75)
Northeast 0.9x	0.77	x	1.65	x	28.07	x	0.63	x	0.7	=	14.15	(75)
Northeast 0.9x	0.77	x	0.64	x	28.07	x	0.63	x	0.7	=	5.49	(75)
Northeast 0.9x	0.77	x	0.69	x	28.07	x	0.63	x	0.7	=	5.92	(75)
Northeast 0.9x	0.77	x	1.64	x	28.07	x	0.63	x	0.7	=	14.07	(75)
Northeast 0.9x	0.77	x	1.65	x	14.2	x	0.63	x	0.7	=	7.16	(75)
Northeast 0.9x	0.77	x	0.64	x	14.2	x	0.63	x	0.7	=	2.78	(75)
Northeast 0.9x	0.77	x	0.69	x	14.2	x	0.63	x	0.7	=	2.99	(75)
Northeast 0.9x	0.77	x	1.64	x	14.2	x	0.63	x	0.7	=	7.12	(75)
Northeast 0.9x	0.77	x	1.65	x	9.21	x	0.63	x	0.7	=	4.65	(75)
Northeast 0.9x	0.77	x	0.64	x	9.21	x	0.63	x	0.7	=	1.8	(75)
Northeast 0.9x	0.77	x	0.69	x	9.21	x	0.63	x	0.7	=	1.94	(75)
Northeast 0.9x	0.77	x	1.64	x	9.21	x	0.63	x	0.7	=	4.62	(75)
Southeast 0.9x	0.77	x	0.73	x	36.79	x	0.63	x	0.7	=	8.21	(77)
Southeast 0.9x	0.77	x	1.77	x	36.79	x	0.63	x	0.7	=	19.9	(77)
Southeast 0.9x	0.77	x	0.72	x	36.79	x	0.63	x	0.7	=	8.1	(77)
Southeast 0.9x	0.77	x	0.81	x	36.79	x	0.63	x	0.7	=	9.11	(77)
Southeast 0.9x	0.77	x	0.73	x	36.79	x	0.63	x	0.7	=	8.21	(77)
Southeast 0.9x	0.77	x	0.67	x	36.79	x	0.63	x	0.7	=	7.53	(77)
Southeast 0.9x	0.77	x	0.73	x	62.67	x	0.63	x	0.7	=	13.98	(77)
Southeast 0.9x	0.77	x	1.77	x	62.67	x	0.63	x	0.7	=	33.9	(77)
Southeast 0.9x	0.77	x	0.72	x	62.67	x	0.63	x	0.7	=	13.79	(77)
Southeast 0.9x	0.77	x	0.81	x	62.67	x	0.63	x	0.7	=	15.51	(77)
Southeast 0.9x	0.77	x	0.73	x	62.67	x	0.63	x	0.7	=	13.98	(77)
Southeast 0.9x	0.77	x	0.67	x	62.67	x	0.63	x	0.7	=	12.83	(77)
Southeast 0.9x	0.77	x	0.73	x	85.75	x	0.63	x	0.7	=	19.13	(77)
Southeast 0.9x	0.77	x	1.77	x	85.75	x	0.63	x	0.7	=	46.39	(77)

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Southeast 0.9x	0.77	x	0.72	x	85.75	x	0.63	x	0.7	=	18.87	(77)
Southeast 0.9x	0.77	x	0.81	x	85.75	x	0.63	x	0.7	=	21.23	(77)
Southeast 0.9x	0.77	x	0.73	x	85.75	x	0.63	x	0.7	=	19.13	(77)
Southeast 0.9x	0.77	x	0.67	x	85.75	x	0.63	x	0.7	=	17.56	(77)
Southeast 0.9x	0.77	x	0.73	x	106.25	x	0.63	x	0.7	=	23.7	(77)
Southeast 0.9x	0.77	x	1.77	x	106.25	x	0.63	x	0.7	=	57.48	(77)
Southeast 0.9x	0.77	x	0.72	x	106.25	x	0.63	x	0.7	=	23.38	(77)
Southeast 0.9x	0.77	x	0.81	x	106.25	x	0.63	x	0.7	=	26.3	(77)
Southeast 0.9x	0.77	x	0.73	x	106.25	x	0.63	x	0.7	=	23.7	(77)
Southeast 0.9x	0.77	x	0.67	x	106.25	x	0.63	x	0.7	=	21.76	(77)
Southeast 0.9x	0.77	x	0.73	x	119.01	x	0.63	x	0.7	=	26.55	(77)
Southeast 0.9x	0.77	x	1.77	x	119.01	x	0.63	x	0.7	=	64.38	(77)
Southeast 0.9x	0.77	x	0.72	x	119.01	x	0.63	x	0.7	=	26.19	(77)
Southeast 0.9x	0.77	x	0.81	x	119.01	x	0.63	x	0.7	=	29.46	(77)
Southeast 0.9x	0.77	x	0.73	x	119.01	x	0.63	x	0.7	=	26.55	(77)
Southeast 0.9x	0.77	x	0.67	x	119.01	x	0.63	x	0.7	=	24.37	(77)
Southeast 0.9x	0.77	x	0.73	x	118.15	x	0.63	x	0.7	=	26.36	(77)
Southeast 0.9x	0.77	x	1.77	x	118.15	x	0.63	x	0.7	=	63.91	(77)
Southeast 0.9x	0.77	x	0.72	x	118.15	x	0.63	x	0.7	=	26	(77)
Southeast 0.9x	0.77	x	0.81	x	118.15	x	0.63	x	0.7	=	29.25	(77)
Southeast 0.9x	0.77	x	0.73	x	118.15	x	0.63	x	0.7	=	26.36	(77)
Southeast 0.9x	0.77	x	0.67	x	118.15	x	0.63	x	0.7	=	24.19	(77)
Southeast 0.9x	0.77	x	0.73	x	113.91	x	0.63	x	0.7	=	25.41	(77)
Southeast 0.9x	0.77	x	1.77	x	113.91	x	0.63	x	0.7	=	61.62	(77)
Southeast 0.9x	0.77	x	0.72	x	113.91	x	0.63	x	0.7	=	25.06	(77)
Southeast 0.9x	0.77	x	0.81	x	113.91	x	0.63	x	0.7	=	28.2	(77)
Southeast 0.9x	0.77	x	0.73	x	113.91	x	0.63	x	0.7	=	25.41	(77)
Southeast 0.9x	0.77	x	0.67	x	113.91	x	0.63	x	0.7	=	23.32	(77)
Southeast 0.9x	0.77	x	0.73	x	104.39	x	0.63	x	0.7	=	23.29	(77)
Southeast 0.9x	0.77	x	1.77	x	104.39	x	0.63	x	0.7	=	56.47	(77)
Southeast 0.9x	0.77	x	0.72	x	104.39	x	0.63	x	0.7	=	22.97	(77)
Southeast 0.9x	0.77	x	0.81	x	104.39	x	0.63	x	0.7	=	25.84	(77)
Southeast 0.9x	0.77	x	0.73	x	104.39	x	0.63	x	0.7	=	23.29	(77)
Southeast 0.9x	0.77	x	0.67	x	104.39	x	0.63	x	0.7	=	21.38	(77)
Southeast 0.9x	0.77	x	0.73	x	92.85	x	0.63	x	0.7	=	20.72	(77)
Southeast 0.9x	0.77	x	1.77	x	92.85	x	0.63	x	0.7	=	50.23	(77)
Southeast 0.9x	0.77	x	0.72	x	92.85	x	0.63	x	0.7	=	20.43	(77)
Southeast 0.9x	0.77	x	0.81	x	92.85	x	0.63	x	0.7	=	22.99	(77)
Southeast 0.9x	0.77	x	0.73	x	92.85	x	0.63	x	0.7	=	20.72	(77)
Southeast 0.9x	0.77	x	0.67	x	92.85	x	0.63	x	0.7	=	19.01	(77)
Southeast 0.9x	0.77	x	0.73	x	69.27	x	0.63	x	0.7	=	15.45	(77)

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Southeast 0.9x	0.77	x	1.77	x	69.27	x	0.63	x	0.7	=	37.47	(77)
Southeast 0.9x	0.77	x	0.72	x	69.27	x	0.63	x	0.7	=	15.24	(77)
Southeast 0.9x	0.77	x	0.81	x	69.27	x	0.63	x	0.7	=	17.15	(77)
Southeast 0.9x	0.77	x	0.73	x	69.27	x	0.63	x	0.7	=	15.45	(77)
Southeast 0.9x	0.77	x	0.67	x	69.27	x	0.63	x	0.7	=	14.18	(77)
Southeast 0.9x	0.77	x	0.73	x	44.07	x	0.63	x	0.7	=	9.83	(77)
Southeast 0.9x	0.77	x	1.77	x	44.07	x	0.63	x	0.7	=	23.84	(77)
Southeast 0.9x	0.77	x	0.72	x	44.07	x	0.63	x	0.7	=	9.7	(77)
Southeast 0.9x	0.77	x	0.81	x	44.07	x	0.63	x	0.7	=	10.91	(77)
Southeast 0.9x	0.77	x	0.73	x	44.07	x	0.63	x	0.7	=	9.83	(77)
Southeast 0.9x	0.77	x	0.67	x	44.07	x	0.63	x	0.7	=	9.02	(77)
Southeast 0.9x	0.77	x	0.73	x	31.49	x	0.63	x	0.7	=	7.02	(77)
Southeast 0.9x	0.77	x	1.77	x	31.49	x	0.63	x	0.7	=	17.03	(77)
Southeast 0.9x	0.77	x	0.72	x	31.49	x	0.63	x	0.7	=	6.93	(77)
Southeast 0.9x	0.77	x	0.81	x	31.49	x	0.63	x	0.7	=	7.79	(77)
Southeast 0.9x	0.77	x	0.73	x	31.49	x	0.63	x	0.7	=	7.02	(77)
Southeast 0.9x	0.77	x	0.67	x	31.49	x	0.63	x	0.7	=	6.45	(77)
Southwest 0.9x	0.77	x	4.72	x	36.79		0.63	x	0.7	=	53.07	(79)
Southwest 0.9x	0.77	x	0.98	x	36.79		0.63	x	0.7	=	11.02	(79)
Southwest 0.9x	0.77	x	1.27	x	36.79		0.63	x	0.7	=	14.28	(79)
Southwest 0.9x	0.77	x	5.23	x	36.79		0.63	x	0.7	=	58.81	(79)
Southwest 0.9x	0.77	x	3.78	x	36.79		0.63	x	0.7	=	85.01	(79)
Southwest 0.9x	0.77	x	1.58	x	36.79		0.63	x	0.7	=	17.77	(79)
Southwest 0.9x	0.77	x	4.72	x	62.67		0.63	x	0.7	=	90.41	(79)
Southwest 0.9x	0.77	x	0.98	x	62.67		0.63	x	0.7	=	18.77	(79)
Southwest 0.9x	0.77	x	1.27	x	62.67		0.63	x	0.7	=	24.33	(79)
Southwest 0.9x	0.77	x	5.23	x	62.67		0.63	x	0.7	=	100.17	(79)
Southwest 0.9x	0.77	x	3.78	x	62.67		0.63	x	0.7	=	144.8	(79)
Southwest 0.9x	0.77	x	1.58	x	62.67		0.63	x	0.7	=	30.26	(79)
Southwest 0.9x	0.77	x	4.72	x	85.75		0.63	x	0.7	=	123.7	(79)
Southwest 0.9x	0.77	x	0.98	x	85.75		0.63	x	0.7	=	25.68	(79)
Southwest 0.9x	0.77	x	1.27	x	85.75		0.63	x	0.7	=	33.28	(79)
Southwest 0.9x	0.77	x	5.23	x	85.75		0.63	x	0.7	=	137.06	(79)
Southwest 0.9x	0.77	x	3.78	x	85.75		0.63	x	0.7	=	198.13	(79)
Southwest 0.9x	0.77	x	1.58	x	85.75		0.63	x	0.7	=	41.41	(79)
Southwest 0.9x	0.77	x	4.72	x	106.25		0.63	x	0.7	=	153.27	(79)
Southwest 0.9x	0.77	x	0.98	x	106.25		0.63	x	0.7	=	31.82	(79)
Southwest 0.9x	0.77	x	1.27	x	106.25		0.63	x	0.7	=	41.24	(79)
Southwest 0.9x	0.77	x	5.23	x	106.25		0.63	x	0.7	=	169.83	(79)
Southwest 0.9x	0.77	x	3.78	x	106.25		0.63	x	0.7	=	245.49	(79)
Southwest 0.9x	0.77	x	1.58	x	106.25		0.63	x	0.7	=	51.31	(79)

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Southwest0.9x	0.77	x	4.72	x	119.01	0.63	x	0.7	=	171.67	(79)
Southwest0.9x	0.77	x	0.98	x	119.01	0.63	x	0.7	=	35.64	(79)
Southwest0.9x	0.77	x	1.27	x	119.01	0.63	x	0.7	=	46.19	(79)
Southwest0.9x	0.77	x	5.23	x	119.01	0.63	x	0.7	=	190.22	(79)
Southwest0.9x	0.77	x	3.78	x	119.01	0.63	x	0.7	=	274.97	(79)
Southwest0.9x	0.77	x	1.58	x	119.01	0.63	x	0.7	=	57.47	(79)
Southwest0.9x	0.77	x	4.72	x	118.15	0.63	x	0.7	=	170.43	(79)
Southwest0.9x	0.77	x	0.98	x	118.15	0.63	x	0.7	=	35.39	(79)
Southwest0.9x	0.77	x	1.27	x	118.15	0.63	x	0.7	=	45.86	(79)
Southwest0.9x	0.77	x	5.23	x	118.15	0.63	x	0.7	=	188.85	(79)
Southwest0.9x	0.77	x	3.78	x	118.15	0.63	x	0.7	=	272.98	(79)
Southwest0.9x	0.77	x	1.58	x	118.15	0.63	x	0.7	=	57.05	(79)
Southwest0.9x	0.77	x	4.72	x	113.91	0.63	x	0.7	=	164.31	(79)
Southwest0.9x	0.77	x	0.98	x	113.91	0.63	x	0.7	=	34.12	(79)
Southwest0.9x	0.77	x	1.27	x	113.91	0.63	x	0.7	=	44.21	(79)
Southwest0.9x	0.77	x	5.23	x	113.91	0.63	x	0.7	=	182.07	(79)
Southwest0.9x	0.77	x	3.78	x	113.91	0.63	x	0.7	=	263.18	(79)
Southwest0.9x	0.77	x	1.58	x	113.91	0.63	x	0.7	=	55	(79)
Southwest0.9x	0.77	x	4.72	x	104.39	0.63	x	0.7	=	150.58	(79)
Southwest0.9x	0.77	x	0.98	x	104.39	0.63	x	0.7	=	31.27	(79)
Southwest0.9x	0.77	x	1.27	x	104.39	0.63	x	0.7	=	40.52	(79)
Southwest0.9x	0.77	x	5.23	x	104.39	0.63	x	0.7	=	166.85	(79)
Southwest0.9x	0.77	x	3.78	x	104.39	0.63	x	0.7	=	241.19	(79)
Southwest0.9x	0.77	x	1.58	x	104.39	0.63	x	0.7	=	50.41	(79)
Southwest0.9x	0.77	x	4.72	x	92.85	0.63	x	0.7	=	133.94	(79)
Southwest0.9x	0.77	x	0.98	x	92.85	0.63	x	0.7	=	27.81	(79)
Southwest0.9x	0.77	x	1.27	x	92.85	0.63	x	0.7	=	36.04	(79)
Southwest0.9x	0.77	x	5.23	x	92.85	0.63	x	0.7	=	148.41	(79)
Southwest0.9x	0.77	x	3.78	x	92.85	0.63	x	0.7	=	214.53	(79)
Southwest0.9x	0.77	x	1.58	x	92.85	0.63	x	0.7	=	44.84	(79)
Southwest0.9x	0.77	x	4.72	x	69.27	0.63	x	0.7	=	99.92	(79)
Southwest0.9x	0.77	x	0.98	x	69.27	0.63	x	0.7	=	20.75	(79)
Southwest0.9x	0.77	x	1.27	x	69.27	0.63	x	0.7	=	26.88	(79)
Southwest0.9x	0.77	x	5.23	x	69.27	0.63	x	0.7	=	110.71	(79)
Southwest0.9x	0.77	x	3.78	x	69.27	0.63	x	0.7	=	160.04	(79)
Southwest0.9x	0.77	x	1.58	x	69.27	0.63	x	0.7	=	33.45	(79)
Southwest0.9x	0.77	x	4.72	x	44.07	0.63	x	0.7	=	63.57	(79)
Southwest0.9x	0.77	x	0.98	x	44.07	0.63	x	0.7	=	13.2	(79)
Southwest0.9x	0.77	x	1.27	x	44.07	0.63	x	0.7	=	17.11	(79)
Southwest0.9x	0.77	x	5.23	x	44.07	0.63	x	0.7	=	70.44	(79)
Southwest0.9x	0.77	x	3.78	x	44.07	0.63	x	0.7	=	101.82	(79)

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Southwest	0.9x	0.77	x	1.58	x	44.07		0.63	x	0.7	=	21.28	(79)
Southwest	0.9x	0.77	x	4.72	x	31.49		0.63	x	0.7	=	45.42	(79)
Southwest	0.9x	0.77	x	0.98	x	31.49		0.63	x	0.7	=	9.43	(79)
Southwest	0.9x	0.77	x	1.27	x	31.49		0.63	x	0.7	=	12.22	(79)
Southwest	0.9x	0.77	x	5.23	x	31.49		0.63	x	0.7	=	50.33	(79)
Southwest	0.9x	0.77	x	3.78	x	31.49		0.63	x	0.7	=	72.75	(79)
Southwest	0.9x	0.77	x	1.58	x	31.49		0.63	x	0.7	=	15.2	(79)
Northwest	0.9x	0.77	x	0.89	x	11.28	x	0.63	x	0.7	=	3.07	(81)
Northwest	0.9x	0.77	x	1.18	x	11.28	x	0.63	x	0.7	=	4.07	(81)
Northwest	0.9x	0.77	x	5.22	x	11.28	x	0.63	x	0.7	=	18	(81)
Northwest	0.9x	0.77	x	0.69	x	11.28	x	0.63	x	0.7	=	2.38	(81)
Northwest	0.9x	0.77	x	1.21	x	11.28	x	0.63	x	0.7	=	4.17	(81)
Northwest	0.9x	0.77	x	0.89	x	22.97	x	0.63	x	0.7	=	6.25	(81)
Northwest	0.9x	0.77	x	1.18	x	22.97	x	0.63	x	0.7	=	8.28	(81)
Northwest	0.9x	0.77	x	5.22	x	22.97	x	0.63	x	0.7	=	36.64	(81)
Northwest	0.9x	0.77	x	0.69	x	22.97	x	0.63	x	0.7	=	4.84	(81)
Northwest	0.9x	0.77	x	1.21	x	22.97	x	0.63	x	0.7	=	8.49	(81)
Northwest	0.9x	0.77	x	0.89	x	41.38	x	0.63	x	0.7	=	11.25	(81)
Northwest	0.9x	0.77	x	1.18	x	41.38	x	0.63	x	0.7	=	14.92	(81)
Northwest	0.9x	0.77	x	5.22	x	41.38	x	0.63	x	0.7	=	66.01	(81)
Northwest	0.9x	0.77	x	0.69	x	41.38	x	0.63	x	0.7	=	8.73	(81)
Northwest	0.9x	0.77	x	1.21	x	41.38	x	0.63	x	0.7	=	15.3	(81)
Northwest	0.9x	0.77	x	0.89	x	67.96	x	0.63	x	0.7	=	18.48	(81)
Northwest	0.9x	0.77	x	1.18	x	67.96	x	0.63	x	0.7	=	24.51	(81)
Northwest	0.9x	0.77	x	5.22	x	67.96	x	0.63	x	0.7	=	108.41	(81)
Northwest	0.9x	0.77	x	0.69	x	67.96	x	0.63	x	0.7	=	14.33	(81)
Northwest	0.9x	0.77	x	1.21	x	67.96	x	0.63	x	0.7	=	25.13	(81)
Northwest	0.9x	0.77	x	0.89	x	91.35	x	0.63	x	0.7	=	24.85	(81)
Northwest	0.9x	0.77	x	1.18	x	91.35	x	0.63	x	0.7	=	32.94	(81)
Northwest	0.9x	0.77	x	5.22	x	91.35	x	0.63	x	0.7	=	145.72	(81)
Northwest	0.9x	0.77	x	0.69	x	91.35	x	0.63	x	0.7	=	19.26	(81)
Northwest	0.9x	0.77	x	1.21	x	91.35	x	0.63	x	0.7	=	33.78	(81)
Northwest	0.9x	0.77	x	0.89	x	97.38	x	0.63	x	0.7	=	26.49	(81)
Northwest	0.9x	0.77	x	1.18	x	97.38	x	0.63	x	0.7	=	35.12	(81)
Northwest	0.9x	0.77	x	5.22	x	97.38	x	0.63	x	0.7	=	155.36	(81)
Northwest	0.9x	0.77	x	0.69	x	97.38	x	0.63	x	0.7	=	20.54	(81)
Northwest	0.9x	0.77	x	1.21	x	97.38	x	0.63	x	0.7	=	36.01	(81)
Northwest	0.9x	0.77	x	0.89	x	91.1	x	0.63	x	0.7	=	24.78	(81)
Northwest	0.9x	0.77	x	1.18	x	91.1	x	0.63	x	0.7	=	32.85	(81)
Northwest	0.9x	0.77	x	5.22	x	91.1	x	0.63	x	0.7	=	145.33	(81)
Northwest	0.9x	0.77	x	0.69	x	91.1	x	0.63	x	0.7	=	19.21	(81)

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Northwest 0.9x	0.77	x	1.21	x	91.1	x	0.63	x	0.7	=	33.69	(81)
Northwest 0.9x	0.77	x	0.89	x	72.63	x	0.63	x	0.7	=	19.75	(81)
Northwest 0.9x	0.77	x	1.18	x	72.63	x	0.63	x	0.7	=	26.19	(81)
Northwest 0.9x	0.77	x	5.22	x	72.63	x	0.63	x	0.7	=	115.86	(81)
Northwest 0.9x	0.77	x	0.69	x	72.63	x	0.63	x	0.7	=	15.32	(81)
Northwest 0.9x	0.77	x	1.21	x	72.63	x	0.63	x	0.7	=	26.86	(81)
Northwest 0.9x	0.77	x	0.89	x	50.42	x	0.63	x	0.7	=	13.71	(81)
Northwest 0.9x	0.77	x	1.18	x	50.42	x	0.63	x	0.7	=	18.18	(81)
Northwest 0.9x	0.77	x	5.22	x	50.42	x	0.63	x	0.7	=	80.44	(81)
Northwest 0.9x	0.77	x	0.69	x	50.42	x	0.63	x	0.7	=	10.63	(81)
Northwest 0.9x	0.77	x	1.21	x	50.42	x	0.63	x	0.7	=	18.65	(81)
Northwest 0.9x	0.77	x	0.89	x	28.07	x	0.63	x	0.7	=	7.63	(81)
Northwest 0.9x	0.77	x	1.18	x	28.07	x	0.63	x	0.7	=	10.12	(81)
Northwest 0.9x	0.77	x	5.22	x	28.07	x	0.63	x	0.7	=	44.78	(81)
Northwest 0.9x	0.77	x	0.69	x	28.07	x	0.63	x	0.7	=	5.92	(81)
Northwest 0.9x	0.77	x	1.21	x	28.07	x	0.63	x	0.7	=	10.38	(81)
Northwest 0.9x	0.77	x	0.89	x	14.2	x	0.63	x	0.7	=	3.86	(81)
Northwest 0.9x	0.77	x	1.18	x	14.2	x	0.63	x	0.7	=	5.12	(81)
Northwest 0.9x	0.77	x	5.22	x	14.2	x	0.63	x	0.7	=	22.65	(81)
Northwest 0.9x	0.77	x	0.69	x	14.2	x	0.63	x	0.7	=	2.99	(81)
Northwest 0.9x	0.77	x	1.21	x	14.2	x	0.63	x	0.7	=	5.25	(81)
Northwest 0.9x	0.77	x	0.89	x	9.21	x	0.63	x	0.7	=	2.51	(81)
Northwest 0.9x	0.77	x	1.18	x	9.21	x	0.63	x	0.7	=	3.32	(81)
Northwest 0.9x	0.77	x	5.22	x	9.21	x	0.63	x	0.7	=	14.7	(81)
Northwest 0.9x	0.77	x	0.69	x	9.21	x	0.63	x	0.7	=	1.94	(81)
Northwest 0.9x	0.77	x	1.21	x	9.21	x	0.63	x	0.7	=	3.41	(81)
Rooflights 0.9x	1	x	1.3	x	32.97	x	0.63	x	0.7	=	16.95	(82)
Rooflights 0.9x	1	x	0.58	x	32.97	x	0.63	x	0.7	=	15.14	(82)
Rooflights 0.9x	1	x	1.3	x	32.97	x	0.63	x	0.7	=	16.95	(82)
Rooflights 0.9x	1	x	1.3	x	64.7	x	0.63	x	0.7	=	33.27	(82)
Rooflights 0.9x	1	x	0.58	x	64.7	x	0.63	x	0.7	=	29.71	(82)
Rooflights 0.9x	1	x	1.3	x	64.7	x	0.63	x	0.7	=	33.27	(82)
Rooflights 0.9x	1	x	1.3	x	107.44	x	0.63	x	0.7	=	55.25	(82)
Rooflights 0.9x	1	x	0.58	x	107.44	x	0.63	x	0.7	=	49.33	(82)
Rooflights 0.9x	1	x	1.3	x	107.44	x	0.63	x	0.7	=	55.25	(82)
Rooflights 0.9x	1	x	1.3	x	158.68	x	0.63	x	0.7	=	81.6	(82)
Rooflights 0.9x	1	x	0.58	x	158.68	x	0.63	x	0.7	=	72.86	(82)
Rooflights 0.9x	1	x	1.3	x	158.68	x	0.63	x	0.7	=	81.6	(82)
Rooflights 0.9x	1	x	1.3	x	196.61	x	0.63	x	0.7	=	101.11	(82)
Rooflights 0.9x	1	x	0.58	x	196.61	x	0.63	x	0.7	=	90.27	(82)
Rooflights 0.9x	1	x	1.3	x	196.61	x	0.63	x	0.7	=	101.11	(82)

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Rooflights 0.9x	1	x	1.3	x	202.3	x	0.63	x	0.7	=	104.03	(82)
Rooflights 0.9x	1	x	0.58	x	202.3	x	0.63	x	0.7	=	92.89	(82)
Rooflights 0.9x	1	x	1.3	x	202.3	x	0.63	x	0.7	=	104.03	(82)
Rooflights 0.9x	1	x	1.3	x	192.17	x	0.63	x	0.7	=	98.82	(82)
Rooflights 0.9x	1	x	0.58	x	192.17	x	0.63	x	0.7	=	88.23	(82)
Rooflights 0.9x	1	x	1.3	x	192.17	x	0.63	x	0.7	=	98.82	(82)
Rooflights 0.9x	1	x	1.3	x	163.57	x	0.63	x	0.7	=	84.12	(82)
Rooflights 0.9x	1	x	0.58	x	163.57	x	0.63	x	0.7	=	75.1	(82)
Rooflights 0.9x	1	x	1.3	x	163.57	x	0.63	x	0.7	=	84.12	(82)
Rooflights 0.9x	1	x	1.3	x	125.56	x	0.63	x	0.7	=	64.57	(82)
Rooflights 0.9x	1	x	0.58	x	125.56	x	0.63	x	0.7	=	57.65	(82)
Rooflights 0.9x	1	x	1.3	x	125.56	x	0.63	x	0.7	=	64.57	(82)
Rooflights 0.9x	1	x	1.3	x	76.97	x	0.63	x	0.7	=	39.58	(82)
Rooflights 0.9x	1	x	0.58	x	76.97	x	0.63	x	0.7	=	35.34	(82)
Rooflights 0.9x	1	x	1.3	x	76.97	x	0.63	x	0.7	=	39.58	(82)
Rooflights 0.9x	1	x	1.3	x	41.13	x	0.63	x	0.7	=	21.15	(82)
Rooflights 0.9x	1	x	0.58	x	41.13	x	0.63	x	0.7	=	18.89	(82)
Rooflights 0.9x	1	x	1.3	x	41.13	x	0.63	x	0.7	=	21.15	(82)
Rooflights 0.9x	1	x	1.3	x	27.1	x	0.63	x	0.7	=	13.94	(82)
Rooflights 0.9x	1	x	0.58	x	27.1	x	0.63	x	0.7	=	12.44	(82)
Rooflights 0.9x	1	x	1.3	x	27.1	x	0.63	x	0.7	=	13.94	(82)

Solar gains in watts, calculated for each month

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

(83)m=	397.68	705.93	1036.04	1392.15	1651.67	1678.58	1602.29	1403.91	1159.23	799.66	481.66	336.81	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	998.57	1304.53	1614.65	1937.86	2162.78	2157.23	2060.4	1868.71	1641.4	1314.97	1035.14	920.07	(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	1	0.99	0.95	0.85	0.68	0.52	0.59	0.84	0.98	1	1	(86)

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

(87)m=	19.45	19.67	20	20.42	20.76	20.94	20.99	20.98	20.83	20.37	19.82	19.42	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.82	19.82	19.82	19.83	19.84	19.85	19.85	19.85	19.84	19.84	19.83	19.83	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.8	0.58	0.39	0.45	0.76	0.97	1	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.76	18.08	18.57	19.17	19.61	19.81	19.84	19.84	19.71	19.1	18.31	17.72	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) =

0.47

(91)

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

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(92)m=	18.56	18.83	19.25	19.76	20.15	20.34	20.38	20.37	20.24	19.7	19.03	18.52	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(93)m=	18.56	18.83	19.25	19.76	20.15	20.34	20.38	20.37	20.24	19.7	19.03	18.52	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm :

(94)m=	1	0.99	0.98	0.93	0.81	0.63	0.45	0.52	0.79	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	996.45	1295.57	1579.57	1801.57	1762.06	1354.55	932.46	967.57	1303.84	1268.58	1029.88	918.71	(95)
--------	--------	---------	---------	---------	---------	---------	--------	--------	---------	---------	---------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	3664.64	3572.38	3261.3	2750.69	2136.61	1438.09	947.22	994.1	1543.75	2300.01	3026.72	3648.64	(97)
--------	---------	---------	--------	---------	---------	---------	--------	-------	---------	---------	---------	---------	------

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

(98)m=	1985.14	1530.02	1251.21	683.36	278.66	0	0	0	0	767.38	1437.73	2031.06	(98)
--------	---------	---------	---------	--------	--------	---	---	---	---	--------	---------	---------	------

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 9964.56

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

51.44 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = $1 - (201) =$

1 (202)

Fraction of total heating from main system 1

(204) = $(202) \times [1 - (203)] =$

1 (204)

Efficiency of main space heating system 1

93.5 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

1985.14	1530.02	1251.21	683.36	278.66	0	0	0	0	767.38	1437.73	2031.06
---------	---------	---------	--------	--------	---	---	---	---	--------	---------	---------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$

2123.14	1636.38	1338.19	730.87	298.04	0	0	0	0	820.73	1537.68	2172.26
---------	---------	---------	--------	--------	---	---	---	---	--------	---------	---------

Total ($kWh/year$) = $Sum(211)_{1..5,10..12} =$ 10657.29 (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	(215)
---------	---	---	---	---	---	---	---	---	---	---	---	---	-------

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

Water heating

Output from water heater (calculated above)

223.52	196.97	206.78	185.24	181.43	161.99	155.45	170.75	170.5	192.08	203.27	218.1
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------

Efficiency of water heater

79.8 (216)

(217)m=	89.29	89.14	88.81	87.98	85.96	79.8	79.8	79.8	79.8	88.13	89.02	89.34	(217)
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, $kWh/month$

(219)m = $(64)m \times 100 \div (217)m$

(219)m=	250.34	220.98	232.83	210.53	211.08	202.99	194.8	213.97	213.66	217.95	228.34	244.13	(219)
---------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------

Total = $Sum(219a)_{1..12} =$ 2641.58

TER WorkSheet: New dwelling design stage

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		10657.29
Water heating fuel used		2641.58
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75 (231)
Electricity for lighting		574.71 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		13948.57 (338)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	2301.97 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	570.58 (264)
Space and water heating	(261) + (262) + (263) + (264) =			2872.55 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	298.27 (268)
Total CO2, kg/year		sum of (265)...(271) =		3209.75 (272)
TER =				24.73 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Antony Straszewski	Stroma Number:	STRO006494
Software Name:	Stroma FSAP 2012	Software Version:	Version: 1.0.5.41

Property Address: Plot 1

Address : 1

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	98.89	(1a) x	2.4	(2a) =	237.34 (3a)
First floor	94.82	(1b) x	2.75	(2b) =	260.75 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	193.71	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	498.09 (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							4	x 10 =	40 (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) =	40	÷ (5) =	0.08 (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			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.33 (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) =		0.33 (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

	0.42	0.41	0.4	0.36	0.36	0.31	0.31	0.31	0.33	0.36	0.37	0.39
--	------	------	-----	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 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 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= 0.59 0.59 0.58 0.57 0.56 0.55 0.55 0.55 0.55 0.56 0.57 0.58 (24d)

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

(25)m= 0.59 0.59 0.58 0.57 0.56 0.55 0.55 0.55 0.55 0.56 0.57 0.58 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			4.08	x 1.4	= 5.712		(26)
Windows Type 1			8.16	x 1/[1/(1.4)+ 0.04]	= 10.82		(27)
Windows Type 2			1.7	x 1/[1/(1.4)+ 0.04]	= 2.25		(27)
Windows Type 3			2.2	x 1/[1/(1.4)+ 0.04]	= 2.92		(27)
Windows Type 4			9.05	x 1/[1/(1.4)+ 0.04]	= 12		(27)
Windows Type 5			1.26	x 1/[1/(1.4)+ 0.04]	= 1.67		(27)
Windows Type 6			3.06	x 1/[1/(1.4)+ 0.04]	= 4.06		(27)
Windows Type 7			1.25	x 1/[1/(1.4)+ 0.04]	= 1.66		(27)
Windows Type 8			2.85	x 1/[1/(1.4)+ 0.04]	= 3.78		(27)
Windows Type 9			1.54	x 1/[1/(1.4)+ 0.04]	= 2.04		(27)
Windows Type 10			2.04	x 1/[1/(1.4)+ 0.04]	= 2.7		(27)
Windows Type 11			6.53	x 1/[1/(1.4)+ 0.04]	= 8.66		(27)
Windows Type 12			9.03	x 1/[1/(1.4)+ 0.04]	= 11.97		(27)
Windows Type 13			2.73	x 1/[1/(1.4)+ 0.04]	= 3.62		(27)
Windows Type 14			1.4	x 1/[1/(1.4)+ 0.04]	= 1.86		(27)
Windows Type 15			1.26	x 1/[1/(1.4)+ 0.04]	= 1.67		(27)
Windows Type 16			1.16	x 1/[1/(1.4)+ 0.04]	= 1.54		(27)

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Windows Type 17			1.1	$\times 1/[1/(1.4) + 0.04] =$	1.46			(27)
Windows Type 18			1.2	$\times 1/[1/(1.4) + 0.04] =$	1.59			(27)
Windows Type 19			1.2	$\times 1/[1/(1.4) + 0.04] =$	1.59			(27)
Windows Type 20			2.1	$\times 1/[1/(1.4) + 0.04] =$	2.78			(27)
Windows Type 21			2.84	$\times 1/[1/(1.12) + 0.04] =$	3.04			(27)
Rooflights Type 1			2.24	$\times 1/[1/(1.8) + 0.04] =$	4.032			(27b)
Rooflights Type 2			1	$\times 1/[1/(1.8) + 0.04] =$	1.8			(27b)
Rooflights Type 3			2.24	$\times 1/[1/(1.8) + 0.04] =$	4.032			(27b)
Floor Type 1			98.89	$\times$	0.14	$=$	13.8446	(28)
Floor Type 2			8.96	$\times$	0.2	$=$	1.792	(28)
Walls Type1	114.26	37.19	77.07	$\times$	0.18	$=$	13.87	(29)
Walls Type2	113.49	35.98	77.51	$\times$	0.18	$=$	13.95	(29)
Walls Type3	5.94	1.1	4.84	$\times$	0.2	$=$	0.97	(29)
Roof Type1	7.85	0	7.85	$\times$	0.16	$=$	1.26	(30)
Roof Type2	99.42	6.48	92.94	$\times$	0.16	$=$	14.87	(30)
Total area of elements, m ²			448.81					(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) =	169.48	(33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	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	43.57	(36)
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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	213.05	(37)
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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=	96.76	96.2	95.64	93.03	92.55	90.28	90.28	89.86	91.15	92.55	93.53	94.56	(38)

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

(39)m=	309.81	309.25	308.69	306.09	305.6	303.33	303.33	302.91	304.2	305.6	306.59	307.62		
Average = Sum(39) _{1...12} /12=													306.08	(39)

Heat loss parameter (HLP), W/m ² K	(40)m = (39)m ÷ (4)	
---	---------------------	--

(40)m=	1.6	1.6	1.59	1.58	1.58	1.57	1.57	1.56	1.57	1.58	1.58	1.59		
Average = Sum(40) _{1...12} /12=													1.58	(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	2.99	(42)
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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	105.3	(43)
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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)

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

(45)m=	171.77	150.23	155.03	135.16	129.69	111.91	103.7	119	120.42	140.34	153.19	166.35		
Total = Sum(45) _{1...12} =													1656.8	(45)

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

(46)m=	25.77	22.54	23.25	20.27	19.45	16.79	15.56	17.85	18.06	21.05	22.98	24.95	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	210	(47)
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If community heating and no tank in dwelling, enter 110 litres in (47)

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):	1.85	(48)
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Temperature factor from Table 2b	0.54	(49)
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Energy lost from water storage, kWh/year	(48) x (49) =	1	(50)
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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)
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Temperature factor from Table 2b	0	(53)
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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
--	-----------------------------	---	------

Enter (50) or (54) in (55)	1	(55)
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Water storage loss calculated for each month ((56)m = (55) x (41)m)

(56)m=	30.97	27.97	30.97	29.97	30.97	29.97	30.97	30.97	29.97	30.97	29.97	30.97	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

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=	30.97	27.97	30.97	29.97	30.97	29.97	30.97	30.97	29.97	30.97	29.97	30.97	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

Primary circuit loss (annual) from Table 3	0	(58)
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Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

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

(59)m=	23.26	21.01	23.26	22.51	23.26	0	0	0	0	23.26	22.51	23.26	
--------	-------	-------	-------	-------	-------	---	---	---	---	-------	-------	-------	--

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

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

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=	226.01	199.22	209.26	187.64	183.92	141.88	134.67	149.97	150.39	194.57	205.67	220.59	
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

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

Output from water heater

(64)m=	226.01	199.22	209.26	187.64	183.92	0	0	0	0	194.57	205.67	220.59		
Output from water heater (annual) _{1...12}													1626.87	(64)

Output immersion

(64)m=	0	0	0	0	0	141.88	134.67	149.97	150.39	0	0	0		
Output from immersion (annual) _{1...12}													576.90861527764	(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=	100.5	89.14	94.93	86.93	86.51	61.19	59.26	64.34	64.02	90.05	92.92	98.7	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	--

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

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

149.69	149.69	149.69	149.69	149.69	149.69	149.69	149.69	149.69	149.69	149.69	149.69
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (66)

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

(67)m=

32.54	28.9	23.51	17.8	13.3	11.23	12.14	15.77	21.17	26.88	31.37	33.45
-------	------	-------	------	------	-------	-------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

365.03	368.82	359.27	338.95	313.3	289.19	273.08	269.3	278.84	299.16	324.81	348.92
--------	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	--------

 (68)

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

(69)m=

37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

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

 (70)

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

(71)m=

-119.75	-119.75	-119.75	-119.75	-119.75	-119.75	-119.75	-119.75	-119.75	-119.75	-119.75	-119.75
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

135.08	132.65	127.6	120.73	116.27	84.98	79.65	86.48	88.91	121.03	129.06	132.66
--------	--------	-------	--------	--------	-------	-------	-------	-------	--------	--------	--------

 (72)

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

(73)m=

600.56	598.27	578.28	545.38	510.78	453.31	432.77	439.46	456.83	514.98	553.15	582.93
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.85</td></tr></table>	2.85	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>9.27</td></tr></table>	9.27	(75)
0.77																			
2.85																			
11.28																			
0.52																			
0.8																			
9.27																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.1</td></tr></table>	1.1	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>3.58</td></tr></table>	3.58	(75)
0.77																			
1.1																			
11.28																			
0.52																			
0.8																			
3.58																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.2</td></tr></table>	1.2	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>3.9</td></tr></table>	3.9	(75)
0.77																			
1.2																			
11.28																			
0.52																			
0.8																			
3.9																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.84</td></tr></table>	2.84	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>9.24</td></tr></table>	9.24	(75)
0.77																			
2.84																			
11.28																			
0.52																			
0.8																			
9.24																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.85</td></tr></table>	2.85	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>18.87</td></tr></table>	18.87	(75)
0.77																			
2.85																			
22.97																			
0.52																			
0.8																			
18.87																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.1</td></tr></table>	1.1	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>7.28</td></tr></table>	7.28	(75)
0.77																			
1.1																			
22.97																			
0.52																			
0.8																			
7.28																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.2</td></tr></table>	1.2	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>7.95</td></tr></table>	7.95	(75)
0.77																			
1.2																			
22.97																			
0.52																			
0.8																			
7.95																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.84</td></tr></table>	2.84	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>18.8</td></tr></table>	18.8	(75)
0.77																			
2.84																			
22.97																			
0.52																			
0.8																			
18.8																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.85</td></tr></table>	2.85	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>34</td></tr></table>	34	(75)
0.77																			
2.85																			
41.38																			
0.52																			
0.8																			
34																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.1</td></tr></table>	1.1	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>13.12</td></tr></table>	13.12	(75)
0.77																			
1.1																			
41.38																			
0.52																			
0.8																			
13.12																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.2</td></tr></table>	1.2	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>14.31</td></tr></table>	14.31	(75)
0.77																			
1.2																			
41.38																			
0.52																			
0.8																			
14.31																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.84</td></tr></table>	2.84	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>33.88</td></tr></table>	33.88	(75)
0.77																			
2.84																			
41.38																			
0.52																			
0.8																			
33.88																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.85</td></tr></table>	2.85	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>55.83</td></tr></table>	55.83	(75)
0.77																			
2.85																			
67.96																			
0.52																			
0.8																			
55.83																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.1</td></tr></table>	1.1	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>21.55</td></tr></table>	21.55	(75)
0.77																			
1.1																			
67.96																			
0.52																			
0.8																			
21.55																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.2</td></tr></table>	1.2	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>23.51</td></tr></table>	23.51	(75)
0.77																			
1.2																			
67.96																			
0.52																			
0.8																			
23.51																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.84</td></tr></table>	2.84	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>55.64</td></tr></table>	55.64	(75)
0.77																			
2.84																			
67.96																			
0.52																			
0.8																			
55.64																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.85</td></tr></table>	2.85	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>75.05</td></tr></table>	75.05	(75)
0.77																			
2.85																			
91.35																			
0.52																			
0.8																			
75.05																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.1</td></tr></table>	1.1	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>28.97</td></tr></table>	28.97	(75)
0.77																			
1.1																			
91.35																			
0.52																			
0.8																			
28.97																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.2</td></tr></table>	1.2	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>31.6</td></tr></table>	31.6	(75)
0.77																			
1.2																			
91.35																			
0.52																			
0.8																			
31.6																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.84</td></tr></table>	2.84	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>74.79</td></tr></table>	74.79	(75)
0.77																			
2.84																			
91.35																			
0.52																			
0.8																			
74.79																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.85</td></tr></table>	2.85	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>80.01</td></tr></table>	80.01	(75)
0.77																			
2.85																			
97.38																			
0.52																			
0.8																			
80.01																			

DER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	1.1	x	97.38	x	0.52	x	0.8	=	30.88	(75)
Northeast 0.9x	0.77	x	1.2	x	97.38	x	0.52	x	0.8	=	33.69	(75)
Northeast 0.9x	0.77	x	2.84	x	97.38	x	0.52	x	0.8	=	79.73	(75)
Northeast 0.9x	0.77	x	2.85	x	91.1	x	0.52	x	0.8	=	74.85	(75)
Northeast 0.9x	0.77	x	1.1	x	91.1	x	0.52	x	0.8	=	28.89	(75)
Northeast 0.9x	0.77	x	1.2	x	91.1	x	0.52	x	0.8	=	31.52	(75)
Northeast 0.9x	0.77	x	2.84	x	91.1	x	0.52	x	0.8	=	74.59	(75)
Northeast 0.9x	0.77	x	2.85	x	72.63	x	0.52	x	0.8	=	59.67	(75)
Northeast 0.9x	0.77	x	1.1	x	72.63	x	0.52	x	0.8	=	23.03	(75)
Northeast 0.9x	0.77	x	1.2	x	72.63	x	0.52	x	0.8	=	25.12	(75)
Northeast 0.9x	0.77	x	2.84	x	72.63	x	0.52	x	0.8	=	59.46	(75)
Northeast 0.9x	0.77	x	2.85	x	50.42	x	0.52	x	0.8	=	41.43	(75)
Northeast 0.9x	0.77	x	1.1	x	50.42	x	0.52	x	0.8	=	15.99	(75)
Northeast 0.9x	0.77	x	1.2	x	50.42	x	0.52	x	0.8	=	17.44	(75)
Northeast 0.9x	0.77	x	2.84	x	50.42	x	0.52	x	0.8	=	41.28	(75)
Northeast 0.9x	0.77	x	2.85	x	28.07	x	0.52	x	0.8	=	23.06	(75)
Northeast 0.9x	0.77	x	1.1	x	28.07	x	0.52	x	0.8	=	8.9	(75)
Northeast 0.9x	0.77	x	1.2	x	28.07	x	0.52	x	0.8	=	9.71	(75)
Northeast 0.9x	0.77	x	2.84	x	28.07	x	0.52	x	0.8	=	22.98	(75)
Northeast 0.9x	0.77	x	2.85	x	14.2	x	0.52	x	0.8	=	11.66	(75)
Northeast 0.9x	0.77	x	1.1	x	14.2	x	0.52	x	0.8	=	4.5	(75)
Northeast 0.9x	0.77	x	1.2	x	14.2	x	0.52	x	0.8	=	4.91	(75)
Northeast 0.9x	0.77	x	2.84	x	14.2	x	0.52	x	0.8	=	11.62	(75)
Northeast 0.9x	0.77	x	2.85	x	9.21	x	0.52	x	0.8	=	7.57	(75)
Northeast 0.9x	0.77	x	1.1	x	9.21	x	0.52	x	0.8	=	2.92	(75)
Northeast 0.9x	0.77	x	1.2	x	9.21	x	0.52	x	0.8	=	3.19	(75)
Northeast 0.9x	0.77	x	2.84	x	9.21	x	0.52	x	0.8	=	7.54	(75)
Southeast 0.9x	0.77	x	1.26	x	36.79	x	0.52	x	0.8	=	13.37	(77)
Southeast 0.9x	0.77	x	3.06	x	36.79	x	0.52	x	0.8	=	32.46	(77)
Southeast 0.9x	0.77	x	1.25	x	36.79	x	0.52	x	0.8	=	13.26	(77)
Southeast 0.9x	0.77	x	1.4	x	36.79	x	0.52	x	0.8	=	14.85	(77)
Southeast 0.9x	0.77	x	1.26	x	36.79	x	0.52	x	0.8	=	13.37	(77)
Southeast 0.9x	0.77	x	1.16	x	36.79	x	0.52	x	0.8	=	12.3	(77)
Southeast 0.9x	0.77	x	1.26	x	62.67	x	0.52	x	0.8	=	22.77	(77)
Southeast 0.9x	0.77	x	3.06	x	62.67	x	0.52	x	0.8	=	55.29	(77)
Southeast 0.9x	0.77	x	1.25	x	62.67	x	0.52	x	0.8	=	22.59	(77)
Southeast 0.9x	0.77	x	1.4	x	62.67	x	0.52	x	0.8	=	25.3	(77)
Southeast 0.9x	0.77	x	1.26	x	62.67	x	0.52	x	0.8	=	22.77	(77)
Southeast 0.9x	0.77	x	1.16	x	62.67	x	0.52	x	0.8	=	20.96	(77)
Southeast 0.9x	0.77	x	1.26	x	85.75	x	0.52	x	0.8	=	31.15	(77)
Southeast 0.9x	0.77	x	3.06	x	85.75	x	0.52	x	0.8	=	75.65	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	1.25	x	85.75	x	0.52	x	0.8	=	30.9	(77)
Southeast 0.9x	0.77	x	1.4	x	85.75	x	0.52	x	0.8	=	34.61	(77)
Southeast 0.9x	0.77	x	1.26	x	85.75	x	0.52	x	0.8	=	31.15	(77)
Southeast 0.9x	0.77	x	1.16	x	85.75	x	0.52	x	0.8	=	28.68	(77)
Southeast 0.9x	0.77	x	1.26	x	106.25	x	0.52	x	0.8	=	38.6	(77)
Southeast 0.9x	0.77	x	3.06	x	106.25	x	0.52	x	0.8	=	93.73	(77)
Southeast 0.9x	0.77	x	1.25	x	106.25	x	0.52	x	0.8	=	38.29	(77)
Southeast 0.9x	0.77	x	1.4	x	106.25	x	0.52	x	0.8	=	42.88	(77)
Southeast 0.9x	0.77	x	1.26	x	106.25	x	0.52	x	0.8	=	38.6	(77)
Southeast 0.9x	0.77	x	1.16	x	106.25	x	0.52	x	0.8	=	35.53	(77)
Southeast 0.9x	0.77	x	1.26	x	119.01	x	0.52	x	0.8	=	43.23	(77)
Southeast 0.9x	0.77	x	3.06	x	119.01	x	0.52	x	0.8	=	104.99	(77)
Southeast 0.9x	0.77	x	1.25	x	119.01	x	0.52	x	0.8	=	42.89	(77)
Southeast 0.9x	0.77	x	1.4	x	119.01	x	0.52	x	0.8	=	48.03	(77)
Southeast 0.9x	0.77	x	1.26	x	119.01	x	0.52	x	0.8	=	43.23	(77)
Southeast 0.9x	0.77	x	1.16	x	119.01	x	0.52	x	0.8	=	39.8	(77)
Southeast 0.9x	0.77	x	1.26	x	118.15	x	0.52	x	0.8	=	42.92	(77)
Southeast 0.9x	0.77	x	3.06	x	118.15	x	0.52	x	0.8	=	104.23	(77)
Southeast 0.9x	0.77	x	1.25	x	118.15	x	0.52	x	0.8	=	42.58	(77)
Southeast 0.9x	0.77	x	1.4	x	118.15	x	0.52	x	0.8	=	47.69	(77)
Southeast 0.9x	0.77	x	1.26	x	118.15	x	0.52	x	0.8	=	42.92	(77)
Southeast 0.9x	0.77	x	1.16	x	118.15	x	0.52	x	0.8	=	39.51	(77)
Southeast 0.9x	0.77	x	1.26	x	113.91	x	0.52	x	0.8	=	41.38	(77)
Southeast 0.9x	0.77	x	3.06	x	113.91	x	0.52	x	0.8	=	100.49	(77)
Southeast 0.9x	0.77	x	1.25	x	113.91	x	0.52	x	0.8	=	41.05	(77)
Southeast 0.9x	0.77	x	1.4	x	113.91	x	0.52	x	0.8	=	45.97	(77)
Southeast 0.9x	0.77	x	1.26	x	113.91	x	0.52	x	0.8	=	41.38	(77)
Southeast 0.9x	0.77	x	1.16	x	113.91	x	0.52	x	0.8	=	38.09	(77)
Southeast 0.9x	0.77	x	1.26	x	104.39	x	0.52	x	0.8	=	37.92	(77)
Southeast 0.9x	0.77	x	3.06	x	104.39	x	0.52	x	0.8	=	92.09	(77)
Southeast 0.9x	0.77	x	1.25	x	104.39	x	0.52	x	0.8	=	37.62	(77)
Southeast 0.9x	0.77	x	1.4	x	104.39	x	0.52	x	0.8	=	42.13	(77)
Southeast 0.9x	0.77	x	1.26	x	104.39	x	0.52	x	0.8	=	37.92	(77)
Southeast 0.9x	0.77	x	1.16	x	104.39	x	0.52	x	0.8	=	34.91	(77)
Southeast 0.9x	0.77	x	1.26	x	92.85	x	0.52	x	0.8	=	33.73	(77)
Southeast 0.9x	0.77	x	3.06	x	92.85	x	0.52	x	0.8	=	81.91	(77)
Southeast 0.9x	0.77	x	1.25	x	92.85	x	0.52	x	0.8	=	33.46	(77)
Southeast 0.9x	0.77	x	1.4	x	92.85	x	0.52	x	0.8	=	37.48	(77)
Southeast 0.9x	0.77	x	1.26	x	92.85	x	0.52	x	0.8	=	33.73	(77)
Southeast 0.9x	0.77	x	1.16	x	92.85	x	0.52	x	0.8	=	31.05	(77)
Southeast 0.9x	0.77	x	1.26	x	69.27	x	0.52	x	0.8	=	25.16	(77)

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Southeast 0.9x	0.77	x	3.06	x	69.27	x	0.52	x	0.8	=	61.11	(77)
Southeast 0.9x	0.77	x	1.25	x	69.27	x	0.52	x	0.8	=	24.96	(77)
Southeast 0.9x	0.77	x	1.4	x	69.27	x	0.52	x	0.8	=	27.96	(77)
Southeast 0.9x	0.77	x	1.26	x	69.27	x	0.52	x	0.8	=	25.16	(77)
Southeast 0.9x	0.77	x	1.16	x	69.27	x	0.52	x	0.8	=	23.16	(77)
Southeast 0.9x	0.77	x	1.26	x	44.07	x	0.52	x	0.8	=	16.01	(77)
Southeast 0.9x	0.77	x	3.06	x	44.07	x	0.52	x	0.8	=	38.88	(77)
Southeast 0.9x	0.77	x	1.25	x	44.07	x	0.52	x	0.8	=	15.88	(77)
Southeast 0.9x	0.77	x	1.4	x	44.07	x	0.52	x	0.8	=	17.79	(77)
Southeast 0.9x	0.77	x	1.26	x	44.07	x	0.52	x	0.8	=	16.01	(77)
Southeast 0.9x	0.77	x	1.16	x	44.07	x	0.52	x	0.8	=	14.74	(77)
Southeast 0.9x	0.77	x	1.26	x	31.49	x	0.52	x	0.8	=	11.44	(77)
Southeast 0.9x	0.77	x	3.06	x	31.49	x	0.52	x	0.8	=	27.78	(77)
Southeast 0.9x	0.77	x	1.25	x	31.49	x	0.52	x	0.8	=	11.35	(77)
Southeast 0.9x	0.77	x	1.4	x	31.49	x	0.52	x	0.8	=	12.71	(77)
Southeast 0.9x	0.77	x	1.26	x	31.49	x	0.52	x	0.8	=	11.44	(77)
Southeast 0.9x	0.77	x	1.16	x	31.49	x	0.52	x	0.8	=	10.53	(77)
Southwest 0.9x	0.77	x	8.16	x	36.79		0.52	x	0.8	=	86.55	(79)
Southwest 0.9x	0.77	x	1.7	x	36.79		0.52	x	0.8	=	18.03	(79)
Southwest 0.9x	0.77	x	2.2	x	36.79		0.52	x	0.8	=	23.34	(79)
Southwest 0.9x	0.77	x	9.05	x	36.79		0.52	x	0.8	=	96	(79)
Southwest 0.9x	0.77	x	6.53	x	36.79		0.52	x	0.8	=	138.53	(79)
Southwest 0.9x	0.77	x	2.73	x	36.79		0.52	x	0.8	=	28.96	(79)
Southwest 0.9x	0.77	x	8.16	x	62.67		0.52	x	0.8	=	147.44	(79)
Southwest 0.9x	0.77	x	1.7	x	62.67		0.52	x	0.8	=	30.72	(79)
Southwest 0.9x	0.77	x	2.2	x	62.67		0.52	x	0.8	=	39.75	(79)
Southwest 0.9x	0.77	x	9.05	x	62.67		0.52	x	0.8	=	163.52	(79)
Southwest 0.9x	0.77	x	6.53	x	62.67		0.52	x	0.8	=	235.97	(79)
Southwest 0.9x	0.77	x	2.73	x	62.67		0.52	x	0.8	=	49.33	(79)
Southwest 0.9x	0.77	x	8.16	x	85.75		0.52	x	0.8	=	201.73	(79)
Southwest 0.9x	0.77	x	1.7	x	85.75		0.52	x	0.8	=	42.03	(79)
Southwest 0.9x	0.77	x	2.2	x	85.75		0.52	x	0.8	=	54.39	(79)
Southwest 0.9x	0.77	x	9.05	x	85.75		0.52	x	0.8	=	223.73	(79)
Southwest 0.9x	0.77	x	6.53	x	85.75		0.52	x	0.8	=	322.86	(79)
Southwest 0.9x	0.77	x	2.73	x	85.75		0.52	x	0.8	=	67.49	(79)
Southwest 0.9x	0.77	x	8.16	x	106.25		0.52	x	0.8	=	249.95	(79)
Southwest 0.9x	0.77	x	1.7	x	106.25		0.52	x	0.8	=	52.07	(79)
Southwest 0.9x	0.77	x	2.2	x	106.25		0.52	x	0.8	=	67.39	(79)
Southwest 0.9x	0.77	x	9.05	x	106.25		0.52	x	0.8	=	277.21	(79)
Southwest 0.9x	0.77	x	6.53	x	106.25		0.52	x	0.8	=	400.04	(79)
Southwest 0.9x	0.77	x	2.73	x	106.25		0.52	x	0.8	=	83.62	(79)

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Southwest0.9x	0.77	x	8.16	x	119.01	0.52	x	0.8	=	279.96	(79)
Southwest0.9x	0.77	x	1.7	x	119.01	0.52	x	0.8	=	58.33	(79)
Southwest0.9x	0.77	x	2.2	x	119.01	0.52	x	0.8	=	75.48	(79)
Southwest0.9x	0.77	x	9.05	x	119.01	0.52	x	0.8	=	310.5	(79)
Southwest0.9x	0.77	x	6.53	x	119.01	0.52	x	0.8	=	448.08	(79)
Southwest0.9x	0.77	x	2.73	x	119.01	0.52	x	0.8	=	93.66	(79)
Southwest0.9x	0.77	x	8.16	x	118.15	0.52	x	0.8	=	277.94	(79)
Southwest0.9x	0.77	x	1.7	x	118.15	0.52	x	0.8	=	57.9	(79)
Southwest0.9x	0.77	x	2.2	x	118.15	0.52	x	0.8	=	74.93	(79)
Southwest0.9x	0.77	x	9.05	x	118.15	0.52	x	0.8	=	308.25	(79)
Southwest0.9x	0.77	x	6.53	x	118.15	0.52	x	0.8	=	444.84	(79)
Southwest0.9x	0.77	x	2.73	x	118.15	0.52	x	0.8	=	92.99	(79)
Southwest0.9x	0.77	x	8.16	x	113.91	0.52	x	0.8	=	267.96	(79)
Southwest0.9x	0.77	x	1.7	x	113.91	0.52	x	0.8	=	55.83	(79)
Southwest0.9x	0.77	x	2.2	x	113.91	0.52	x	0.8	=	72.25	(79)
Southwest0.9x	0.77	x	9.05	x	113.91	0.52	x	0.8	=	297.19	(79)
Southwest0.9x	0.77	x	6.53	x	113.91	0.52	x	0.8	=	428.87	(79)
Southwest0.9x	0.77	x	2.73	x	113.91	0.52	x	0.8	=	89.65	(79)
Southwest0.9x	0.77	x	8.16	x	104.39	0.52	x	0.8	=	245.57	(79)
Southwest0.9x	0.77	x	1.7	x	104.39	0.52	x	0.8	=	51.16	(79)
Southwest0.9x	0.77	x	2.2	x	104.39	0.52	x	0.8	=	66.21	(79)
Southwest0.9x	0.77	x	9.05	x	104.39	0.52	x	0.8	=	272.36	(79)
Southwest0.9x	0.77	x	6.53	x	104.39	0.52	x	0.8	=	393.03	(79)
Southwest0.9x	0.77	x	2.73	x	104.39	0.52	x	0.8	=	82.16	(79)
Southwest0.9x	0.77	x	8.16	x	92.85	0.52	x	0.8	=	218.43	(79)
Southwest0.9x	0.77	x	1.7	x	92.85	0.52	x	0.8	=	45.51	(79)
Southwest0.9x	0.77	x	2.2	x	92.85	0.52	x	0.8	=	58.89	(79)
Southwest0.9x	0.77	x	9.05	x	92.85	0.52	x	0.8	=	242.25	(79)
Southwest0.9x	0.77	x	6.53	x	92.85	0.52	x	0.8	=	349.59	(79)
Southwest0.9x	0.77	x	2.73	x	92.85	0.52	x	0.8	=	73.08	(79)
Southwest0.9x	0.77	x	8.16	x	69.27	0.52	x	0.8	=	162.95	(79)
Southwest0.9x	0.77	x	1.7	x	69.27	0.52	x	0.8	=	33.95	(79)
Southwest0.9x	0.77	x	2.2	x	69.27	0.52	x	0.8	=	43.93	(79)
Southwest0.9x	0.77	x	9.05	x	69.27	0.52	x	0.8	=	180.72	(79)
Southwest0.9x	0.77	x	6.53	x	69.27	0.52	x	0.8	=	260.8	(79)
Southwest0.9x	0.77	x	2.73	x	69.27	0.52	x	0.8	=	54.52	(79)
Southwest0.9x	0.77	x	8.16	x	44.07	0.52	x	0.8	=	103.67	(79)
Southwest0.9x	0.77	x	1.7	x	44.07	0.52	x	0.8	=	21.6	(79)
Southwest0.9x	0.77	x	2.2	x	44.07	0.52	x	0.8	=	27.95	(79)
Southwest0.9x	0.77	x	9.05	x	44.07	0.52	x	0.8	=	114.98	(79)
Southwest0.9x	0.77	x	6.53	x	44.07	0.52	x	0.8	=	165.93	(79)

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Southwest0.9x	0.77	x	2.73	x	44.07		0.52	x	0.8	=	34.68	(79)
Southwest0.9x	0.77	x	8.16	x	31.49		0.52	x	0.8	=	74.07	(79)
Southwest0.9x	0.77	x	1.7	x	31.49		0.52	x	0.8	=	15.43	(79)
Southwest0.9x	0.77	x	2.2	x	31.49		0.52	x	0.8	=	19.97	(79)
Southwest0.9x	0.77	x	9.05	x	31.49		0.52	x	0.8	=	82.15	(79)
Southwest0.9x	0.77	x	6.53	x	31.49		0.52	x	0.8	=	118.55	(79)
Southwest0.9x	0.77	x	2.73	x	31.49		0.52	x	0.8	=	24.78	(79)
Northwest0.9x	0.77	x	1.54	x	11.28	x	0.52	x	0.8	=	5.01	(81)
Northwest0.9x	0.77	x	2.04	x	11.28	x	0.52	x	0.8	=	6.64	(81)
Northwest0.9x	0.77	x	9.03	x	11.28	x	0.52	x	0.8	=	29.37	(81)
Northwest0.9x	0.77	x	1.2	x	11.28	x	0.52	x	0.8	=	3.9	(81)
Northwest0.9x	0.77	x	2.1	x	11.28	x	0.52	x	0.8	=	6.83	(81)
Northwest0.9x	0.77	x	1.54	x	22.97	x	0.52	x	0.8	=	10.2	(81)
Northwest0.9x	0.77	x	2.04	x	22.97	x	0.52	x	0.8	=	13.51	(81)
Northwest0.9x	0.77	x	9.03	x	22.97	x	0.52	x	0.8	=	59.79	(81)
Northwest0.9x	0.77	x	1.2	x	22.97	x	0.52	x	0.8	=	7.95	(81)
Northwest0.9x	0.77	x	2.1	x	22.97	x	0.52	x	0.8	=	13.9	(81)
Northwest0.9x	0.77	x	1.54	x	41.38	x	0.52	x	0.8	=	18.37	(81)
Northwest0.9x	0.77	x	2.04	x	41.38	x	0.52	x	0.8	=	24.34	(81)
Northwest0.9x	0.77	x	9.03	x	41.38	x	0.52	x	0.8	=	107.72	(81)
Northwest0.9x	0.77	x	1.2	x	41.38	x	0.52	x	0.8	=	14.31	(81)
Northwest0.9x	0.77	x	2.1	x	41.38	x	0.52	x	0.8	=	25.05	(81)
Northwest0.9x	0.77	x	1.54	x	67.96	x	0.52	x	0.8	=	30.17	(81)
Northwest0.9x	0.77	x	2.04	x	67.96	x	0.52	x	0.8	=	39.97	(81)
Northwest0.9x	0.77	x	9.03	x	67.96	x	0.52	x	0.8	=	176.91	(81)
Northwest0.9x	0.77	x	1.2	x	67.96	x	0.52	x	0.8	=	23.51	(81)
Northwest0.9x	0.77	x	2.1	x	67.96	x	0.52	x	0.8	=	41.14	(81)
Northwest0.9x	0.77	x	1.54	x	91.35	x	0.52	x	0.8	=	40.55	(81)
Northwest0.9x	0.77	x	2.04	x	91.35	x	0.52	x	0.8	=	53.72	(81)
Northwest0.9x	0.77	x	9.03	x	91.35	x	0.52	x	0.8	=	237.8	(81)
Northwest0.9x	0.77	x	1.2	x	91.35	x	0.52	x	0.8	=	31.6	(81)
Northwest0.9x	0.77	x	2.1	x	91.35	x	0.52	x	0.8	=	55.3	(81)
Northwest0.9x	0.77	x	1.54	x	97.38	x	0.52	x	0.8	=	43.24	(81)
Northwest0.9x	0.77	x	2.04	x	97.38	x	0.52	x	0.8	=	57.27	(81)
Northwest0.9x	0.77	x	9.03	x	97.38	x	0.52	x	0.8	=	253.52	(81)
Northwest0.9x	0.77	x	1.2	x	97.38	x	0.52	x	0.8	=	33.69	(81)
Northwest0.9x	0.77	x	2.1	x	97.38	x	0.52	x	0.8	=	58.96	(81)
Northwest0.9x	0.77	x	1.54	x	91.1	x	0.52	x	0.8	=	40.45	(81)
Northwest0.9x	0.77	x	2.04	x	91.1	x	0.52	x	0.8	=	53.58	(81)
Northwest0.9x	0.77	x	9.03	x	91.1	x	0.52	x	0.8	=	237.16	(81)
Northwest0.9x	0.77	x	1.2	x	91.1	x	0.52	x	0.8	=	31.52	(81)

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Northwest 0.9x	0.77	x	2.1	x	91.1	x	0.52	x	0.8	=	55.15	(81)
Northwest 0.9x	0.77	x	1.54	x	72.63	x	0.52	x	0.8	=	32.24	(81)
Northwest 0.9x	0.77	x	2.04	x	72.63	x	0.52	x	0.8	=	42.71	(81)
Northwest 0.9x	0.77	x	9.03	x	72.63	x	0.52	x	0.8	=	189.07	(81)
Northwest 0.9x	0.77	x	1.2	x	72.63	x	0.52	x	0.8	=	25.12	(81)
Northwest 0.9x	0.77	x	2.1	x	72.63	x	0.52	x	0.8	=	43.97	(81)
Northwest 0.9x	0.77	x	1.54	x	50.42	x	0.52	x	0.8	=	22.38	(81)
Northwest 0.9x	0.77	x	2.04	x	50.42	x	0.52	x	0.8	=	29.65	(81)
Northwest 0.9x	0.77	x	9.03	x	50.42	x	0.52	x	0.8	=	131.26	(81)
Northwest 0.9x	0.77	x	1.2	x	50.42	x	0.52	x	0.8	=	17.44	(81)
Northwest 0.9x	0.77	x	2.1	x	50.42	x	0.52	x	0.8	=	30.52	(81)
Northwest 0.9x	0.77	x	1.54	x	28.07	x	0.52	x	0.8	=	12.46	(81)
Northwest 0.9x	0.77	x	2.04	x	28.07	x	0.52	x	0.8	=	16.51	(81)
Northwest 0.9x	0.77	x	9.03	x	28.07	x	0.52	x	0.8	=	73.07	(81)
Northwest 0.9x	0.77	x	1.2	x	28.07	x	0.52	x	0.8	=	9.71	(81)
Northwest 0.9x	0.77	x	2.1	x	28.07	x	0.52	x	0.8	=	16.99	(81)
Northwest 0.9x	0.77	x	1.54	x	14.2	x	0.52	x	0.8	=	6.3	(81)
Northwest 0.9x	0.77	x	2.04	x	14.2	x	0.52	x	0.8	=	8.35	(81)
Northwest 0.9x	0.77	x	9.03	x	14.2	x	0.52	x	0.8	=	36.96	(81)
Northwest 0.9x	0.77	x	1.2	x	14.2	x	0.52	x	0.8	=	4.91	(81)
Northwest 0.9x	0.77	x	2.1	x	14.2	x	0.52	x	0.8	=	8.59	(81)
Northwest 0.9x	0.77	x	1.54	x	9.21	x	0.52	x	0.8	=	4.09	(81)
Northwest 0.9x	0.77	x	2.04	x	9.21	x	0.52	x	0.8	=	5.42	(81)
Northwest 0.9x	0.77	x	9.03	x	9.21	x	0.52	x	0.8	=	23.99	(81)
Northwest 0.9x	0.77	x	1.2	x	9.21	x	0.52	x	0.8	=	3.19	(81)
Northwest 0.9x	0.77	x	2.1	x	9.21	x	0.52	x	0.8	=	5.58	(81)
Rooflights 0.9x	1	x	2.24	x	32.97	x	0.45	x	0.8	=	23.93	(82)
Rooflights 0.9x	1	x	1	x	32.97	x	0.45	x	0.8	=	21.36	(82)
Rooflights 0.9x	1	x	2.24	x	32.97	x	0.45	x	0.8	=	23.93	(82)
Rooflights 0.9x	1	x	2.24	x	64.7	x	0.45	x	0.8	=	46.96	(82)
Rooflights 0.9x	1	x	1	x	64.7	x	0.45	x	0.8	=	41.92	(82)
Rooflights 0.9x	1	x	2.24	x	64.7	x	0.45	x	0.8	=	46.96	(82)
Rooflights 0.9x	1	x	2.24	x	107.44	x	0.45	x	0.8	=	77.98	(82)
Rooflights 0.9x	1	x	1	x	107.44	x	0.45	x	0.8	=	69.62	(82)
Rooflights 0.9x	1	x	2.24	x	107.44	x	0.45	x	0.8	=	77.98	(82)
Rooflights 0.9x	1	x	2.24	x	158.68	x	0.45	x	0.8	=	115.17	(82)
Rooflights 0.9x	1	x	1	x	158.68	x	0.45	x	0.8	=	102.83	(82)
Rooflights 0.9x	1	x	2.24	x	158.68	x	0.45	x	0.8	=	115.17	(82)
Rooflights 0.9x	1	x	2.24	x	196.61	x	0.45	x	0.8	=	142.69	(82)
Rooflights 0.9x	1	x	1	x	196.61	x	0.45	x	0.8	=	127.4	(82)
Rooflights 0.9x	1	x	2.24	x	196.61	x	0.45	x	0.8	=	142.69	(82)

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Rooflights 0.9x	1	x	2.24	x	202.3	x	0.45	x	0.8	=	146.82	(82)
Rooflights 0.9x	1	x	1	x	202.3	x	0.45	x	0.8	=	131.09	(82)
Rooflights 0.9x	1	x	2.24	x	202.3	x	0.45	x	0.8	=	146.82	(82)
Rooflights 0.9x	1	x	2.24	x	192.17	x	0.45	x	0.8	=	139.47	(82)
Rooflights 0.9x	1	x	1	x	192.17	x	0.45	x	0.8	=	124.52	(82)
Rooflights 0.9x	1	x	2.24	x	192.17	x	0.45	x	0.8	=	139.47	(82)
Rooflights 0.9x	1	x	2.24	x	163.57	x	0.45	x	0.8	=	118.71	(82)
Rooflights 0.9x	1	x	1	x	163.57	x	0.45	x	0.8	=	106	(82)
Rooflights 0.9x	1	x	2.24	x	163.57	x	0.45	x	0.8	=	118.71	(82)
Rooflights 0.9x	1	x	2.24	x	125.56	x	0.45	x	0.8	=	91.12	(82)
Rooflights 0.9x	1	x	1	x	125.56	x	0.45	x	0.8	=	81.36	(82)
Rooflights 0.9x	1	x	2.24	x	125.56	x	0.45	x	0.8	=	91.12	(82)
Rooflights 0.9x	1	x	2.24	x	76.97	x	0.45	x	0.8	=	55.86	(82)
Rooflights 0.9x	1	x	1	x	76.97	x	0.45	x	0.8	=	49.88	(82)
Rooflights 0.9x	1	x	2.24	x	76.97	x	0.45	x	0.8	=	55.86	(82)
Rooflights 0.9x	1	x	2.24	x	41.13	x	0.45	x	0.8	=	29.85	(82)
Rooflights 0.9x	1	x	1	x	41.13	x	0.45	x	0.8	=	26.66	(82)
Rooflights 0.9x	1	x	2.24	x	41.13	x	0.45	x	0.8	=	29.85	(82)
Rooflights 0.9x	1	x	2.24	x	27.1	x	0.45	x	0.8	=	19.67	(82)
Rooflights 0.9x	1	x	1	x	27.1	x	0.45	x	0.8	=	17.56	(82)
Rooflights 0.9x	1	x	2.24	x	27.1	x	0.45	x	0.8	=	19.67	(82)

Solar gains in watts, calculated for each month

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

(83)m=	637.97	1130.45	1655.04	2219.3	2630.35	2672.42	2551.26	2236.9	1850.1	1279.35	772.3	540.58	(83)
--------	--------	---------	---------	--------	---------	---------	---------	--------	--------	---------	-------	--------	------

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

(84)m=	1238.52	1728.72	2233.32	2764.68	3141.13	3125.72	2984.03	2676.36	2306.93	1794.33	1325.45	1123.51	(84)
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.89	0.76	0.58	0.44	0.5	0.76	0.95	0.99	1	(86)

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

(87)m=	19.61	19.83	20.15	20.51	20.77	20.89	20.92	20.91	20.81	20.44	19.93	19.57	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.61	19.62	19.62	19.63	19.63	19.64	19.64	19.64	19.64	19.63	19.63	19.62	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.95	0.86	0.68	0.47	0.31	0.36	0.66	0.93	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	17.78	18.11	18.57	19.08	19.39	19.51	19.54	19.53	19.45	18.99	18.28	17.73	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.47

(91)

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

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(92)m=

18.65	18.92	19.32	19.75	20.04	20.16	20.19	20.19	20.09	19.67	19.06	18.6
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

 (92)

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

(93)m=

18.65	18.92	19.32	19.75	20.04	20.16	20.19	20.19	20.09	19.67	19.06	18.6
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm :

(94)m=

1	0.98	0.95	0.86	0.71	0.52	0.36	0.42	0.7	0.93	0.99	1
---	------	------	------	------	------	------	------	-----	------	------	---

 (94)

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

(95)m=

1232.35	1699.62	2122.35	2386.39	2221.13	1616.52	1075.76	1123.36	1603.78	1664.89	1309.73	1119.61
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (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=

4444.28	4336.61	3956.41	3322.49	2549.92	1687.65	1088.64	1146.53	1823.29	2772.01	3665.49	4429.82
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (97)

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

(98)m=

2389.68	1772.06	1364.54	673.99	244.62	0	0	0	0	823.7	1696.14	2462.8
---------	---------	---------	--------	--------	---	---	---	---	-------	---------	--------

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

11427.53

 (98)

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

58.99

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

Fraction of space heat from main system(s)

(202) = $1 - (201) =$

1

 (202)

Fraction of total heating from main system 1

(204) = $(202) \times [1 - (203)] =$

1

 (204)

Efficiency of main space heating system 1

466.33

 (206)

Efficiency of secondary/supplementary heating system, %

0

 (208)

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

Space heating requirement (calculated above)

2389.68	1772.06	1364.54	673.99	244.62	0	0	0	0	823.7	1696.14	2462.8
---------	---------	---------	--------	--------	---	---	---	---	-------	---------	--------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

512.45	380	292.61	144.53	52.46	0	0	0	0	176.63	363.72	528.12
--------	-----	--------	--------	-------	---	---	---	---	--------	--------	--------

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

2450.53

 (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)

Water heating

Output from water heater (calculated above)

226.01	199.22	209.26	187.64	183.92	0	0	0	0	194.57	205.67	220.59
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Efficiency of water heater

190.32

 (216)

(217)m=

190.32	190.32	190.32	190.32	190.32	190.32	190.32	190.32	190.32	190.32	190.32	190.32
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (217)

Fuel for water heating, $kWh/month$

(219)m = $(64)m \times 100 \div (217)m$

(219)m=

118.75	104.68	109.95	98.59	96.64	0	0	0	0	102.23	108.07	115.9
--------	--------	--------	-------	-------	---	---	---	---	--------	--------	-------

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

854.81

 (219)

Water heating requirement (immersion)

0	0	0	0	0	141.88	134.67	149.97	150.39	0	0	0
---	---	---	---	---	--------	--------	--------	--------	---	---	---

Efficiency of water heater (immersion) - <http://www.stroma.com>

100

 (219)

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(217)m=	0	0	0	0	0	100	100	100	100	0	0	0	(217)
---------	---	---	---	---	---	-----	-----	-----	-----	---	---	---	-------

Fuel for water heating (Immersion), kWh/month

(219)m = [(64)m + (218) m] x 100 ÷ (217)m

(219)m=	0	0	0	0	0	141.88	134.67	149.97	150.39	0	0	0	
Total = Sum(219a) _{1...12} =												576.91	(219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2450.53
Water heating fuel used		854.81
Water heating fuel used (Immersion)		576.91
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0 (231)
Electricity for lighting		574.71 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3880.05 (338)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	1271.82 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	443.65 (264)
Water heating (Immersion)	(219) x	0.519	299.42 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2014.89 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	0 (267)
Electricity for lighting	(232) x	0.519	298.27 (268)
Total CO2, kg/year		sum of (265)...(271) =	2313.16 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	11.94 (273)
El rating (section 14)			87 (274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Antony Straszewski	Stroma Number:	STRO006494
Software Name:	Stroma FSAP 2012	Software Version:	Version: 1.0.5.41

Property Address: Plot 2

Address : 2

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	100.09	(1a) x	2.4	(2a) =	240.22
First floor	89.9	(1b) x	2.75	(2b) =	247.23
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	189.99	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	487.44
					(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							4	x 10 =	40
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.08
<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
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<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
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.33
<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
Shelter factor	(20) = 1 - [0.075 x (19)] =		1
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.33

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.42	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

(24a)

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

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

(24b)

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

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(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=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58
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(24d)

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

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58
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(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			3.84	x 1.2	= 4.608		(26)
Windows Type 1			6.16	x 1/[1/(1.4)+ 0.04] =	8.17		(27)
Windows Type 2			5.69	x 1/[1/(1.4)+ 0.04] =	7.54		(27)
Windows Type 3			0.45	x 1/[1/(1.4)+ 0.04] =	0.6		(27)
Windows Type 4			0.63	x 1/[1/(1.4)+ 0.04] =	0.84		(27)
Windows Type 5			1.47	x 1/[1/(1.4)+ 0.04] =	1.95		(27)
Windows Type 6			0.64	x 1/[1/(1.4)+ 0.04] =	0.85		(27)
Windows Type 7			1.06	x 1/[1/(1.4)+ 0.04] =	1.41		(27)
Windows Type 8			5.39	x 1/[1/(1.4)+ 0.04] =	7.15		(27)
Windows Type 9			4.98	x 1/[1/(1.4)+ 0.04] =	6.6		(27)
Windows Type 10			1.54	x 1/[1/(1.4)+ 0.04] =	2.04		(27)
Windows Type 11			4.62	x 1/[1/(1.4)+ 0.04] =	6.12		(27)
Windows Type 12			1.12	x 1/[1/(1.4)+ 0.04] =	1.48		(27)
Windows Type 13			0.46	x 1/[1/(1.4)+ 0.04] =	0.61		(27)
Windows Type 14			2.51	x 1/[1/(1.4)+ 0.04] =	3.33		(27)
Rooflights Type 1			1.436229	x 1/[1/(1.7) + 0.04] =	2.441589		(27b)
Rooflights Type 2			0.6411734	x 1/[1/(1.7) + 0.04] =	1.089995		(27b)

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Floor Type 1			100.09	x	0.13	=	13.0117			(28)
Floor Type 2			12.79	x	0.13	=	1.6627			(28)
Walls Type1	111.07	20.39	90.68	x	0.18	=	16.32			(29)
Walls Type2	129.33	22.16	107.17	x	0.18	=	19.29			(29)
Roof	119.91	4.95	114.96	x	0.13	=	14.94			(30)
Total area of elements, m ²			473.19							(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) =	129.04	(33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	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		38.49	(36)
if details of thermal bridging are not known (36) = 0.05 x (31)			

Total fabric heat loss	(33) + (36) =	167.52	(37)
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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=	94.84	94.28	93.74	91.16	90.68	88.43	88.43	88.02	89.3	90.68	91.65	92.67	(38)

Heat transfer coefficient, W/K											(39)m = (37) + (38)m		
(39)m=	262.37	261.81	261.26	258.68	258.2	255.96	255.96	255.54	256.82	258.2	259.18	260.2	
Average = Sum(39) _{1...12} /12=												258.68	(39)

Heat loss parameter (HLP), W/m²K											(40)m = (39)m ÷ (4)		
(40)m=	1.38	1.38	1.38	1.36	1.36	1.35	1.35	1.35	1.35	1.36	1.36	1.37	
Average = Sum(40) _{1...12} /12=												1.36	(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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N	2.99	(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	105.19	(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=	115.7	111.5	107.29	103.08	98.87	94.67	94.67	98.87	103.08	107.29	111.5	115.7	
	Total = Sum(44) _{1...12} =											1262.23	(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=	171.59	150.07	154.86	135.01	129.55	111.79	103.59	118.87	120.29	140.18	153.02	166.17	
	Total = Sum(45) _{1...12} =											1654.98	(45)

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

(46)m=	25.74	22.51	23.23	20.25	19.43	16.77	15.54	17.83	18.04	21.03	22.95	24.93	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

TER WorkSheet: New dwelling design stage

Water storage loss:

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

150

 (47)

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

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

Water storage loss:

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

1.7

 (48)

Temperature factor from Table 2b

0.54

 (49)

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

0.92

 (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)

0.92

 (55)

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

(56)m=

28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

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

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

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (59)

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

(61)m=

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

 (61)

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

(62)m=

223.33	196.81	206.61	185.09	181.29	161.87	155.33	170.62	170.37	191.93	203.1	217.92
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (62)

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

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

(63)m=

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

 (63)

Output from water heater

(64)m=

223.33	196.81	206.61	185.09	181.29	161.87	155.33	170.62	170.37	191.93	203.1	217.92
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Output from water heater (annual) _{1...12}	2264.26
---	---------

 (64)

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

(65)m=

98.45	87.29	92.89	84.95	84.47	77.23	75.84	80.92	80.06	88.01	90.94	96.65
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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
149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44

 (66)

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

(67)m=

32.22	28.62	23.27	17.62	13.17	11.12	12.02	15.62	20.96	26.62	31.07	33.12
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

361.43	365.18	355.73	335.61	310.21	286.34	270.39	266.64	276.09	296.21	321.61	345.48
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

TER WorkSheet: New dwelling design stage

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

(69)m=

37.94	37.94	37.94	37.94	37.94	37.94	37.94	37.94	37.94	37.94	37.94	37.94
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-119.56	-119.56	-119.56	-119.56	-119.56	-119.56	-119.56	-119.56	-119.56	-119.56	-119.56	-119.56
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

132.32	129.9	124.85	117.99	113.54	107.27	101.94	108.76	111.19	118.29	126.31	129.91
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (72)

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

(73)m=

596.81	594.53	574.69	542.05	507.75	475.56	455.18	461.86	479.08	511.95	549.82	579.34
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>2.17</td></tr></table>	2.17	(75)
0.77																			
0.63																			
11.28																			
0.63																			
0.7																			
2.17																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>2.21</td></tr></table>	2.21	(75)
0.77																			
0.64																			
11.28																			
0.63																			
0.7																			
2.21																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>4.42</td></tr></table>	4.42	(75)
0.77																			
0.63																			
22.97																			
0.63																			
0.7																			
4.42																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>4.49</td></tr></table>	4.49	(75)
0.77																			
0.64																			
22.97																			
0.63																			
0.7																			
4.49																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>7.97</td></tr></table>	7.97	(75)
0.77																			
0.63																			
41.38																			
0.63																			
0.7																			
7.97																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>8.09</td></tr></table>	8.09	(75)
0.77																			
0.64																			
41.38																			
0.63																			
0.7																			
8.09																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>13.08</td></tr></table>	13.08	(75)
0.77																			
0.63																			
67.96																			
0.63																			
0.7																			
13.08																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>13.29</td></tr></table>	13.29	(75)
0.77																			
0.64																			
67.96																			
0.63																			
0.7																			
13.29																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>17.59</td></tr></table>	17.59	(75)
0.77																			
0.63																			
91.35																			
0.63																			
0.7																			
17.59																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>17.87</td></tr></table>	17.87	(75)
0.77																			
0.64																			
91.35																			
0.63																			
0.7																			
17.87																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>18.75</td></tr></table>	18.75	(75)
0.77																			
0.63																			
97.38																			
0.63																			
0.7																			
18.75																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>19.05</td></tr></table>	19.05	(75)
0.77																			
0.64																			
97.38																			
0.63																			
0.7																			
19.05																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>17.54</td></tr></table>	17.54	(75)
0.77																			
0.63																			
91.1																			
0.63																			
0.7																			
17.54																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>17.82</td></tr></table>	17.82	(75)
0.77																			
0.64																			
91.1																			
0.63																			
0.7																			
17.82																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>13.98</td></tr></table>	13.98	(75)
0.77																			
0.63																			
72.63																			
0.63																			
0.7																			
13.98																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>14.21</td></tr></table>	14.21	(75)
0.77																			
0.64																			
72.63																			
0.63																			
0.7																			
14.21																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>9.71</td></tr></table>	9.71	(75)
0.77																			
0.63																			
50.42																			
0.63																			
0.7																			
9.71																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>9.86</td></tr></table>	9.86	(75)
0.77																			
0.64																			
50.42																			
0.63																			
0.7																			
9.86																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>5.4</td></tr></table>	5.4	(75)
0.77																			
0.63																			
28.07																			
0.63																			
0.7																			
5.4																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>5.49</td></tr></table>	5.49	(75)
0.77																			
0.64																			
28.07																			
0.63																			
0.7																			
5.49																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>2.73</td></tr></table>	2.73	(75)
0.77																			
0.63																			
14.2																			
0.63																			
0.7																			
2.73																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>2.78</td></tr></table>	2.78	(75)
0.77																			
0.64																			
14.2																			
0.63																			
0.7																			
2.78																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>1.77</td></tr></table>	1.77	(75)
0.77																			
0.63																			
9.21																			
0.63																			
0.7																			
1.77																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.64</td></tr></table>	0.64	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>1.8</td></tr></table>	1.8	(75)
0.77																			
0.64																			
9.21																			
0.63																			
0.7																			
1.8																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.45</td></tr></table>	0.45	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>10.12</td></tr></table>	10.12	(77)
0.77																			
0.45																			
36.79																			
0.63																			
0.7																			
10.12																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.54</td></tr></table>	1.54	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>34.63</td></tr></table>	34.63	(77)
0.77																			
1.54																			
36.79																			
0.63																			
0.7																			
34.63																			

TER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	4.62	x	36.79	x	0.63	x	0.7	=	51.95	(77)
Southeast 0.9x	0.77	x	0.45	x	62.67	x	0.63	x	0.7	=	17.24	(77)
Southeast 0.9x	0.77	x	1.54	x	62.67	x	0.63	x	0.7	=	58.99	(77)
Southeast 0.9x	0.77	x	4.62	x	62.67	x	0.63	x	0.7	=	88.49	(77)
Southeast 0.9x	0.77	x	0.45	x	85.75	x	0.63	x	0.7	=	23.59	(77)
Southeast 0.9x	0.77	x	1.54	x	85.75	x	0.63	x	0.7	=	80.72	(77)
Southeast 0.9x	0.77	x	4.62	x	85.75	x	0.63	x	0.7	=	121.08	(77)
Southeast 0.9x	0.77	x	0.45	x	106.25	x	0.63	x	0.7	=	29.22	(77)
Southeast 0.9x	0.77	x	1.54	x	106.25	x	0.63	x	0.7	=	100.01	(77)
Southeast 0.9x	0.77	x	4.62	x	106.25	x	0.63	x	0.7	=	150.02	(77)
Southeast 0.9x	0.77	x	0.45	x	119.01	x	0.63	x	0.7	=	32.73	(77)
Southeast 0.9x	0.77	x	1.54	x	119.01	x	0.63	x	0.7	=	112.02	(77)
Southeast 0.9x	0.77	x	4.62	x	119.01	x	0.63	x	0.7	=	168.03	(77)
Southeast 0.9x	0.77	x	0.45	x	118.15	x	0.63	x	0.7	=	32.5	(77)
Southeast 0.9x	0.77	x	1.54	x	118.15	x	0.63	x	0.7	=	111.21	(77)
Southeast 0.9x	0.77	x	4.62	x	118.15	x	0.63	x	0.7	=	166.82	(77)
Southeast 0.9x	0.77	x	0.45	x	113.91	x	0.63	x	0.7	=	31.33	(77)
Southeast 0.9x	0.77	x	1.54	x	113.91	x	0.63	x	0.7	=	107.22	(77)
Southeast 0.9x	0.77	x	4.62	x	113.91	x	0.63	x	0.7	=	160.83	(77)
Southeast 0.9x	0.77	x	0.45	x	104.39	x	0.63	x	0.7	=	28.71	(77)
Southeast 0.9x	0.77	x	1.54	x	104.39	x	0.63	x	0.7	=	98.26	(77)
Southeast 0.9x	0.77	x	4.62	x	104.39	x	0.63	x	0.7	=	147.39	(77)
Southeast 0.9x	0.77	x	0.45	x	92.85	x	0.63	x	0.7	=	25.54	(77)
Southeast 0.9x	0.77	x	1.54	x	92.85	x	0.63	x	0.7	=	87.4	(77)
Southeast 0.9x	0.77	x	4.62	x	92.85	x	0.63	x	0.7	=	131.1	(77)
Southeast 0.9x	0.77	x	0.45	x	69.27	x	0.63	x	0.7	=	19.05	(77)
Southeast 0.9x	0.77	x	1.54	x	69.27	x	0.63	x	0.7	=	65.2	(77)
Southeast 0.9x	0.77	x	4.62	x	69.27	x	0.63	x	0.7	=	97.8	(77)
Southeast 0.9x	0.77	x	0.45	x	44.07	x	0.63	x	0.7	=	12.12	(77)
Southeast 0.9x	0.77	x	1.54	x	44.07	x	0.63	x	0.7	=	41.48	(77)
Southeast 0.9x	0.77	x	4.62	x	44.07	x	0.63	x	0.7	=	62.22	(77)
Southeast 0.9x	0.77	x	0.45	x	31.49	x	0.63	x	0.7	=	8.66	(77)
Southeast 0.9x	0.77	x	1.54	x	31.49	x	0.63	x	0.7	=	29.64	(77)
Southeast 0.9x	0.77	x	4.62	x	31.49	x	0.63	x	0.7	=	44.46	(77)
Southwest 0.9x	0.77	x	6.16	x	36.79		0.63	x	0.7	=	69.27	(79)
Southwest 0.9x	0.77	x	5.69	x	36.79		0.63	x	0.7	=	63.98	(79)
Southwest 0.9x	0.77	x	5.39	x	36.79		0.63	x	0.7	=	60.61	(79)
Southwest 0.9x	0.77	x	4.98	x	36.79		0.63	x	0.7	=	56	(79)
Southwest 0.9x	0.77	x	0.46	x	36.79		0.63	x	0.7	=	5.17	(79)
Southwest 0.9x	0.77	x	6.16	x	62.67		0.63	x	0.7	=	117.99	(79)
Southwest 0.9x	0.77	x	5.69	x	62.67		0.63	x	0.7	=	108.99	(79)

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Southwest0.9x	0.77	x	5.39	x	62.67	0.63	x	0.7	=	103.24	(79)
Southwest0.9x	0.77	x	4.98	x	62.67	0.63	x	0.7	=	95.39	(79)
Southwest0.9x	0.77	x	0.46	x	62.67	0.63	x	0.7	=	8.81	(79)
Southwest0.9x	0.77	x	6.16	x	85.75	0.63	x	0.7	=	161.44	(79)
Southwest0.9x	0.77	x	5.69	x	85.75	0.63	x	0.7	=	149.12	(79)
Southwest0.9x	0.77	x	5.39	x	85.75	0.63	x	0.7	=	141.26	(79)
Southwest0.9x	0.77	x	4.98	x	85.75	0.63	x	0.7	=	130.51	(79)
Southwest0.9x	0.77	x	0.46	x	85.75	0.63	x	0.7	=	12.06	(79)
Southwest0.9x	0.77	x	6.16	x	106.25	0.63	x	0.7	=	200.03	(79)
Southwest0.9x	0.77	x	5.69	x	106.25	0.63	x	0.7	=	184.76	(79)
Southwest0.9x	0.77	x	5.39	x	106.25	0.63	x	0.7	=	175.02	(79)
Southwest0.9x	0.77	x	4.98	x	106.25	0.63	x	0.7	=	161.71	(79)
Southwest0.9x	0.77	x	0.46	x	106.25	0.63	x	0.7	=	14.94	(79)
Southwest0.9x	0.77	x	6.16	x	119.01	0.63	x	0.7	=	224.05	(79)
Southwest0.9x	0.77	x	5.69	x	119.01	0.63	x	0.7	=	206.95	(79)
Southwest0.9x	0.77	x	5.39	x	119.01	0.63	x	0.7	=	196.04	(79)
Southwest0.9x	0.77	x	4.98	x	119.01	0.63	x	0.7	=	181.13	(79)
Southwest0.9x	0.77	x	0.46	x	119.01	0.63	x	0.7	=	16.73	(79)
Southwest0.9x	0.77	x	6.16	x	118.15	0.63	x	0.7	=	222.43	(79)
Southwest0.9x	0.77	x	5.69	x	118.15	0.63	x	0.7	=	205.46	(79)
Southwest0.9x	0.77	x	5.39	x	118.15	0.63	x	0.7	=	194.62	(79)
Southwest0.9x	0.77	x	4.98	x	118.15	0.63	x	0.7	=	179.82	(79)
Southwest0.9x	0.77	x	0.46	x	118.15	0.63	x	0.7	=	16.61	(79)
Southwest0.9x	0.77	x	6.16	x	113.91	0.63	x	0.7	=	214.44	(79)
Southwest0.9x	0.77	x	5.69	x	113.91	0.63	x	0.7	=	198.08	(79)
Southwest0.9x	0.77	x	5.39	x	113.91	0.63	x	0.7	=	187.64	(79)
Southwest0.9x	0.77	x	4.98	x	113.91	0.63	x	0.7	=	173.36	(79)
Southwest0.9x	0.77	x	0.46	x	113.91	0.63	x	0.7	=	16.01	(79)
Southwest0.9x	0.77	x	6.16	x	104.39	0.63	x	0.7	=	196.52	(79)
Southwest0.9x	0.77	x	5.69	x	104.39	0.63	x	0.7	=	181.53	(79)
Southwest0.9x	0.77	x	5.39	x	104.39	0.63	x	0.7	=	171.96	(79)
Southwest0.9x	0.77	x	4.98	x	104.39	0.63	x	0.7	=	158.88	(79)
Southwest0.9x	0.77	x	0.46	x	104.39	0.63	x	0.7	=	14.68	(79)
Southwest0.9x	0.77	x	6.16	x	92.85	0.63	x	0.7	=	174.8	(79)
Southwest0.9x	0.77	x	5.69	x	92.85	0.63	x	0.7	=	161.46	(79)
Southwest0.9x	0.77	x	5.39	x	92.85	0.63	x	0.7	=	152.95	(79)
Southwest0.9x	0.77	x	4.98	x	92.85	0.63	x	0.7	=	141.32	(79)
Southwest0.9x	0.77	x	0.46	x	92.85	0.63	x	0.7	=	13.05	(79)
Southwest0.9x	0.77	x	6.16	x	69.27	0.63	x	0.7	=	130.4	(79)
Southwest0.9x	0.77	x	5.69	x	69.27	0.63	x	0.7	=	120.45	(79)
Southwest0.9x	0.77	x	5.39	x	69.27	0.63	x	0.7	=	114.1	(79)

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Southwest	0.9x	0.77	x	4.98	x	69.27	0.63	x	0.7	=	105.42	(79)
Southwest	0.9x	0.77	x	0.46	x	69.27	0.63	x	0.7	=	9.74	(79)
Southwest	0.9x	0.77	x	6.16	x	44.07	0.63	x	0.7	=	82.97	(79)
Southwest	0.9x	0.77	x	5.69	x	44.07	0.63	x	0.7	=	76.64	(79)
Southwest	0.9x	0.77	x	5.39	x	44.07	0.63	x	0.7	=	72.6	(79)
Southwest	0.9x	0.77	x	4.98	x	44.07	0.63	x	0.7	=	67.07	(79)
Southwest	0.9x	0.77	x	0.46	x	44.07	0.63	x	0.7	=	6.2	(79)
Southwest	0.9x	0.77	x	6.16	x	31.49	0.63	x	0.7	=	59.28	(79)
Southwest	0.9x	0.77	x	5.69	x	31.49	0.63	x	0.7	=	54.76	(79)
Southwest	0.9x	0.77	x	5.39	x	31.49	0.63	x	0.7	=	51.87	(79)
Southwest	0.9x	0.77	x	4.98	x	31.49	0.63	x	0.7	=	47.92	(79)
Southwest	0.9x	0.77	x	0.46	x	31.49	0.63	x	0.7	=	4.43	(79)
Northwest	0.9x	0.77	x	1.47	x	11.28	0.63	x	0.7	=	5.07	(81)
Northwest	0.9x	0.77	x	1.06	x	11.28	0.63	x	0.7	=	3.66	(81)
Northwest	0.9x	0.77	x	1.12	x	11.28	0.63	x	0.7	=	3.86	(81)
Northwest	0.9x	0.77	x	2.51	x	11.28	0.63	x	0.7	=	8.66	(81)
Northwest	0.9x	0.77	x	1.47	x	22.97	0.63	x	0.7	=	10.32	(81)
Northwest	0.9x	0.77	x	1.06	x	22.97	0.63	x	0.7	=	7.44	(81)
Northwest	0.9x	0.77	x	1.12	x	22.97	0.63	x	0.7	=	7.86	(81)
Northwest	0.9x	0.77	x	2.51	x	22.97	0.63	x	0.7	=	17.62	(81)
Northwest	0.9x	0.77	x	1.47	x	41.38	0.63	x	0.7	=	18.59	(81)
Northwest	0.9x	0.77	x	1.06	x	41.38	0.63	x	0.7	=	13.4	(81)
Northwest	0.9x	0.77	x	1.12	x	41.38	0.63	x	0.7	=	14.16	(81)
Northwest	0.9x	0.77	x	2.51	x	41.38	0.63	x	0.7	=	31.74	(81)
Northwest	0.9x	0.77	x	1.47	x	67.96	0.63	x	0.7	=	30.53	(81)
Northwest	0.9x	0.77	x	1.06	x	67.96	0.63	x	0.7	=	22.01	(81)
Northwest	0.9x	0.77	x	1.12	x	67.96	0.63	x	0.7	=	23.26	(81)
Northwest	0.9x	0.77	x	2.51	x	67.96	0.63	x	0.7	=	52.13	(81)
Northwest	0.9x	0.77	x	1.47	x	91.35	0.63	x	0.7	=	41.04	(81)
Northwest	0.9x	0.77	x	1.06	x	91.35	0.63	x	0.7	=	29.59	(81)
Northwest	0.9x	0.77	x	1.12	x	91.35	0.63	x	0.7	=	31.27	(81)
Northwest	0.9x	0.77	x	2.51	x	91.35	0.63	x	0.7	=	70.07	(81)
Northwest	0.9x	0.77	x	1.47	x	97.38	0.63	x	0.7	=	43.75	(81)
Northwest	0.9x	0.77	x	1.06	x	97.38	0.63	x	0.7	=	31.55	(81)
Northwest	0.9x	0.77	x	1.12	x	97.38	0.63	x	0.7	=	33.33	(81)
Northwest	0.9x	0.77	x	2.51	x	97.38	0.63	x	0.7	=	74.7	(81)
Northwest	0.9x	0.77	x	1.47	x	91.1	0.63	x	0.7	=	40.93	(81)
Northwest	0.9x	0.77	x	1.06	x	91.1	0.63	x	0.7	=	29.51	(81)
Northwest	0.9x	0.77	x	1.12	x	91.1	0.63	x	0.7	=	31.18	(81)
Northwest	0.9x	0.77	x	2.51	x	91.1	0.63	x	0.7	=	69.88	(81)
Northwest	0.9x	0.77	x	1.47	x	72.63	0.63	x	0.7	=	32.63	(81)

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Northwest 0.9x	0.77	x	1.06	x	72.63	x	0.63	x	0.7	=	23.53	(81)
Northwest 0.9x	0.77	x	1.12	x	72.63	x	0.63	x	0.7	=	24.86	(81)
Northwest 0.9x	0.77	x	2.51	x	72.63	x	0.63	x	0.7	=	55.71	(81)
Northwest 0.9x	0.77	x	1.47	x	50.42	x	0.63	x	0.7	=	22.65	(81)
Northwest 0.9x	0.77	x	1.06	x	50.42	x	0.63	x	0.7	=	16.33	(81)
Northwest 0.9x	0.77	x	1.12	x	50.42	x	0.63	x	0.7	=	17.26	(81)
Northwest 0.9x	0.77	x	2.51	x	50.42	x	0.63	x	0.7	=	38.68	(81)
Northwest 0.9x	0.77	x	1.47	x	28.07	x	0.63	x	0.7	=	12.61	(81)
Northwest 0.9x	0.77	x	1.06	x	28.07	x	0.63	x	0.7	=	9.09	(81)
Northwest 0.9x	0.77	x	1.12	x	28.07	x	0.63	x	0.7	=	9.61	(81)
Northwest 0.9x	0.77	x	2.51	x	28.07	x	0.63	x	0.7	=	21.53	(81)
Northwest 0.9x	0.77	x	1.47	x	14.2	x	0.63	x	0.7	=	6.38	(81)
Northwest 0.9x	0.77	x	1.06	x	14.2	x	0.63	x	0.7	=	4.6	(81)
Northwest 0.9x	0.77	x	1.12	x	14.2	x	0.63	x	0.7	=	4.86	(81)
Northwest 0.9x	0.77	x	2.51	x	14.2	x	0.63	x	0.7	=	10.89	(81)
Northwest 0.9x	0.77	x	1.47	x	9.21	x	0.63	x	0.7	=	4.14	(81)
Northwest 0.9x	0.77	x	1.06	x	9.21	x	0.63	x	0.7	=	2.98	(81)
Northwest 0.9x	0.77	x	1.12	x	9.21	x	0.63	x	0.7	=	3.15	(81)
Northwest 0.9x	0.77	x	2.51	x	9.21	x	0.63	x	0.7	=	7.07	(81)
Rooflights 0.9x	1	x	1.44	x	26	x	0.63	x	0.7	=	44.46	(82)
Rooflights 0.9x	1	x	0.64	x	26	x	0.63	x	0.7	=	6.62	(82)
Rooflights 0.9x	1	x	1.44	x	54	x	0.63	x	0.7	=	92.35	(82)
Rooflights 0.9x	1	x	0.64	x	54	x	0.63	x	0.7	=	13.74	(82)
Rooflights 0.9x	1	x	1.44	x	96	x	0.63	x	0.7	=	164.17	(82)
Rooflights 0.9x	1	x	0.64	x	96	x	0.63	x	0.7	=	24.43	(82)
Rooflights 0.9x	1	x	1.44	x	150	x	0.63	x	0.7	=	256.52	(82)
Rooflights 0.9x	1	x	0.64	x	150	x	0.63	x	0.7	=	38.17	(82)
Rooflights 0.9x	1	x	1.44	x	192	x	0.63	x	0.7	=	328.34	(82)
Rooflights 0.9x	1	x	0.64	x	192	x	0.63	x	0.7	=	48.86	(82)
Rooflights 0.9x	1	x	1.44	x	200	x	0.63	x	0.7	=	342.02	(82)
Rooflights 0.9x	1	x	0.64	x	200	x	0.63	x	0.7	=	50.9	(82)
Rooflights 0.9x	1	x	1.44	x	189	x	0.63	x	0.7	=	323.21	(82)
Rooflights 0.9x	1	x	0.64	x	189	x	0.63	x	0.7	=	48.1	(82)
Rooflights 0.9x	1	x	1.44	x	157	x	0.63	x	0.7	=	268.49	(82)
Rooflights 0.9x	1	x	0.64	x	157	x	0.63	x	0.7	=	39.95	(82)
Rooflights 0.9x	1	x	1.44	x	115	x	0.63	x	0.7	=	196.66	(82)
Rooflights 0.9x	1	x	0.64	x	115	x	0.63	x	0.7	=	29.27	(82)
Rooflights 0.9x	1	x	1.44	x	66	x	0.63	x	0.7	=	112.87	(82)
Rooflights 0.9x	1	x	0.64	x	66	x	0.63	x	0.7	=	16.8	(82)
Rooflights 0.9x	1	x	1.44	x	33	x	0.63	x	0.7	=	56.43	(82)
Rooflights 0.9x	1	x	0.64	x	33	x	0.63	x	0.7	=	8.4	(82)

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Rooflights 0.9x

1

 x

1.44

 x

21

 x

0.63

 x

0.7

 =

35.91

 (82)

Rooflights 0.9x

1

 x

0.64

 x

21

 x

0.63

 x

0.7

 =

5.34

 (82)

Solar gains in watts, calculated for each month

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

(83)m=

428.43	757.37	1102.32	1464.72	1722.31	1743.52	1667.1	1471.28	1228.04	855.56	518.36	363.19
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 (83)

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

(84)m=

1025.24	1351.9	1677.01	2006.77	2230.07	2219.07	2122.27	1933.14	1707.12	1367.52	1068.18	942.53
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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
1	1	0.98	0.94	0.84	0.68	0.52	0.58	0.83	0.97	1	1

 (86)

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

(87)m=

19.41	19.64	19.98	20.41	20.75	20.93	20.98	20.97	20.83	20.36	19.79	19.37
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 (87)

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

(88)m=

19.78	19.78	19.78	19.79	19.79	19.8	19.8	19.81	19.8	19.79	19.79	19.79
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 (88)

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

(89)m=

1	0.99	0.98	0.92	0.79	0.57	0.38	0.44	0.75	0.96	1	1
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 (89)

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

(90)m=

17.67	18.01	18.51	19.12	19.56	19.76	19.8	19.8	19.67	19.06	18.24	17.62
-------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------

 (90)

fLA = Living area ÷ (4) =

0.45

 (91)

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

(92)m=

18.46	18.75	19.18	19.71	20.1	20.3	20.34	20.33	20.2	19.65	18.95	18.42
-------	-------	-------	-------	------	------	-------	-------	------	-------	-------	-------

 (92)

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

(93)m=

18.46	18.75	19.18	19.71	20.1	20.3	20.34	20.33	20.2	19.65	18.95	18.42
-------	-------	-------	-------	------	------	-------	-------	------	-------	-------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=

1	0.99	0.97	0.92	0.8	0.62	0.44	0.51	0.78	0.96	0.99	1
---	------	------	------	-----	------	------	------	------	------	------	---

 (94)

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

(95)m=

1022.5	1340.35	1633.52	1848.76	1792.35	1371.51	941.28	977.64	1329.67	1310.82	1061.43	940.77
--------	---------	---------	---------	---------	---------	--------	--------	---------	---------	---------	--------

 (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=

3714.88	3625.64	3312.97	2795.78	2169.89	1457.85	956.81	1004.78	1566.17	2335.94	3070.25	3698.79
---------	---------	---------	---------	---------	---------	--------	---------	---------	---------	---------	---------

 (97)

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

(98)m=

2003.13	1535.71	1249.51	681.86	280.89	0	0	0	0	762.69	1446.35	2051.97
---------	---------	---------	--------	--------	---	---	---	---	--------	---------	---------

 (98)

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

10012.11

 (98)

Space heating requirement in kWh/m²/year

52.7

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

TER 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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
2003.13	1535.71	1249.51	681.86	280.89	0	0	0	0	762.69	1446.35	2051.97	
(211)m = {[(98)m × (204)] } × 100 ÷ (206)												
2142.39	1642.48	1336.37	729.26	300.41	0	0	0	0	815.71	1546.9	2194.62	
Total (kWh/year) = Sum(211) _{1..5,10...12} =												10708.14

Space heating fuel (secondary), kWh/month												
= {[(98)m × (201)] } × 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)													
223.33	196.81	206.61	185.09	181.29	161.87	155.33	170.62	170.37	191.93	203.1	217.92		
Efficiency of water heater												79.8	(216)
(217)m=	89.3	89.14	88.81	87.98	85.98	79.8	79.8	79.8	79.8	88.12	89.03	89.35	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	250.1	220.78	232.64	210.37	210.86	202.84	194.65	213.8	213.49	217.8	228.12	243.89	
Total = Sum(219a) _{1...12} =												2639.35	(219)

Annual totals

	kWh/year												kWh/year
Space heating fuel used, main system 1													10708.14
Water heating fuel used													2639.35
Electricity for pumps, fans and electric keep-hot													
central heating pump:													30
boiler with a fan-assisted flue													45
Total electricity for the above, kWh/year	sum of (230a)...(230g) =												75
Electricity for lighting													569.05
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =													13991.54

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) ×		0.216	=	2312.96
Space heating (secondary)	(215) ×		0.519	=	0
Water heating	(219) ×		0.216	=	570.1
Space and water heating	(261) + (262) + (263) + (264) =				2883.06
Electricity for pumps, fans and electric keep-hot	(231) ×		0.519	=	38.93

TER WorkSheet: New dwelling design stage

Electricity for lighting	(232) x	0.519	=	295.33	(268)
Total CO2, kg/year		sum of (265)...(271) =		3217.32	(272)
TER =				25.28	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Antony Straszewski	Stroma Number:	STRO006494
Software Name:	Stroma FSAP 2012	Software Version:	Version: 1.0.5.41

Property Address: Plot 2

Address : 2

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	100.09	(1a) x	2.4	(2a) =	240.22 (3a)
First floor	89.9	(1b) x	2.75	(2b) =	247.23 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	189.99	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	487.44 (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							4	x 10 =	40 (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) =	40	÷ (5) =	0.08 (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			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.33 (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) =		0.33 (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

	0.42	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 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 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= 0.59 0.59 0.58 0.57 0.56 0.55 0.55 0.55 0.56 0.56 0.57 0.58 (24d)

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

(25)m= 0.59 0.59 0.58 0.57 0.56 0.55 0.55 0.55 0.56 0.56 0.57 0.58 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			3.84	x 1.4	= 5.376		(26)
Windows Type 1			9.6	x 1/[1/(1.4)+ 0.04]	= 12.73		(27)
Windows Type 2			8.88	x 1/[1/(1.4)+ 0.04]	= 11.77		(27)
Windows Type 3			0.7	x 1/[1/(1.4)+ 0.04]	= 0.93		(27)
Windows Type 4			0.99	x 1/[1/(1.4)+ 0.04]	= 1.31		(27)
Windows Type 5			2.3	x 1/[1/(1.4)+ 0.04]	= 3.05		(27)
Windows Type 6			1	x 1/[1/(1.4)+ 0.04]	= 1.33		(27)
Windows Type 7			1.65	x 1/[1/(1.4)+ 0.04]	= 2.19		(27)
Windows Type 8			8.4	x 1/[1/(1.4)+ 0.04]	= 11.14		(27)
Windows Type 9			7.77	x 1/[1/(1.4)+ 0.04]	= 10.3		(27)
Windows Type 10			2.4	x 1/[1/(1.4)+ 0.04]	= 3.18		(27)
Windows Type 11			7.2	x 1/[1/(1.4)+ 0.04]	= 9.55		(27)
Windows Type 12			1.74	x 1/[1/(1.4)+ 0.04]	= 2.31		(27)
Windows Type 13			0.72	x 1/[1/(1.4)+ 0.04]	= 0.95		(27)
Windows Type 14			3.92	x 1/[1/(1.4)+ 0.04]	= 5.2		(27)
Rooflights Type 1			2.24	x 1/[1/(1.8) + 0.04]	= 4.032		(27b)
Rooflights Type 2			1	x 1/[1/(1.8) + 0.04]	= 1.8		(27b)

DER WorkSheet: New dwelling design stage

Floor Type 1			100.09	x	0.14	=	14.0126			(28)
Floor Type 2			12.79	x	0.2	=	2.558			(28)
Walls Type1	111.07	29.66	81.41	x	0.18	=	14.65			(29)
Walls Type2	129.33	34.55	94.78	x	0.2	=	18.96			(29)
Roof	119.91	7.72	112.19	x	0.16	=	17.95			(30)
Total area of elements, m ²			473.19							(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) = 166.51 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 45.57 (36)

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

Total fabric heat loss (33) + (36) = 212.08 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	94.84	94.28	93.74	91.16	90.68	88.43	88.43	88.02	89.3	90.68	91.65	92.67	(38)

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

(39)m=	306.92	306.36	305.82	303.24	302.76	300.51	300.51	300.1	301.38	302.76	303.73	304.75	
	Average = Sum(39) _{1...12} /12=											303.24	(39)

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

(40)m=	1.62	1.61	1.61	1.6	1.59	1.58	1.58	1.58	1.59	1.59	1.6	1.6	
	Average = Sum(40) _{1...12} /12=											1.6	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.99 (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) + 36 105.19 (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=	115.7	111.5	107.29	103.08	98.87	94.67	94.67	98.87	103.08	107.29	111.5	115.7	
	Total = Sum(44) _{1...12} =											1262.23	(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=	171.59	150.07	154.86	135.01	129.55	111.79	103.59	118.87	120.29	140.18	153.02	166.17	
	Total = Sum(45) _{1...12} =											1654.98	(45)

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

(46)m=	25.74	22.51	23.23	20.25	19.43	16.77	15.54	17.83	18.04	21.03	22.95	24.93	(46)
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DER WorkSheet: New dwelling design stage

Water storage loss:

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

210

 (47)

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

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

Water storage loss:

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

1.85

 (48)

Temperature factor from Table 2b

0.54

 (49)

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

1

 (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)

1

 (55)

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

(56)m=

30.97	27.97	30.97	29.97	30.97	29.97	30.97	30.97	29.97	30.97	29.97	30.97
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

30.97	27.97	30.97	29.97	30.97	29.97	30.97	30.97	29.97	30.97	29.97	30.97
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

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

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

(59)m=

23.26	21.01	23.26	22.51	23.26	0	0	0	0	23.26	22.51	23.26
-------	-------	-------	-------	-------	---	---	---	---	-------	-------	-------

 (59)

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

(61)m=

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

 (61)

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

(62)m=

225.82	199.05	209.09	187.49	183.78	141.76	134.56	149.84	150.26	194.42	205.5	220.4
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------

 (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=

225.82	199.05	209.09	187.49	183.78	0	0	0	0	194.42	205.5	220.4
--------	--------	--------	--------	--------	---	---	---	---	--------	-------	-------

Output from water heater (annual) _{1...12}	1625.56
---	---------

 (64)

Output immersion

(64)m=

0	0	0	0	0	141.76	134.56	149.84	150.26	0	0	0
---	---	---	---	---	--------	--------	--------	--------	---	---	---

Output from immersion (annual) _{1...12}	576.410965757155
--	------------------

 (64)

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

(65)m=

100.44	89.09	94.88	86.88	86.46	61.15	59.22	64.3	63.97	90	92.87	98.64
--------	-------	-------	-------	-------	-------	-------	------	-------	----	-------	-------

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44

 (66)

DER WorkSheet: New dwelling design stage

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

(67)m=

32.22	28.62	23.27	17.62	13.17	11.12	12.02	15.62	20.96	26.62	31.07	33.12
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

361.43	365.18	355.73	335.61	310.21	286.34	270.39	266.64	276.09	296.21	321.61	345.48
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

37.94	37.94	37.94	37.94	37.94	37.94	37.94	37.94	37.94	37.94	37.94	37.94
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

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

 (70)

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

(71)m=

-119.56	-119.56	-119.56	-119.56	-119.56	-119.56	-119.56	-119.56	-119.56	-119.56	-119.56	-119.56
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

135	132.57	127.52	120.66	116.21	84.92	79.59	86.42	88.85	120.96	128.98	132.58
-----	--------	--------	--------	--------	-------	-------	-------	-------	--------	--------	--------

 (72)

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

(73)m=

596.48	594.2	574.36	541.72	507.42	450.22	429.84	436.52	453.74	511.63	549.49	579.01
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 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.99</td></tr></table>	0.99	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>3.22</td></tr></table>	3.22	(75)
0.77																			
0.99																			
11.28																			
0.52																			
0.8																			
3.22																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1</td></tr></table>	1	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>3.25</td></tr></table>	3.25	(75)
0.77																			
1																			
11.28																			
0.52																			
0.8																			
3.25																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.99</td></tr></table>	0.99	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>6.55</td></tr></table>	6.55	(75)
0.77																			
0.99																			
22.97																			
0.52																			
0.8																			
6.55																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1</td></tr></table>	1	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>6.62</td></tr></table>	6.62	(75)
0.77																			
1																			
22.97																			
0.52																			
0.8																			
6.62																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.99</td></tr></table>	0.99	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>11.81</td></tr></table>	11.81	(75)
0.77																			
0.99																			
41.38																			
0.52																			
0.8																			
11.81																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1</td></tr></table>	1	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>11.93</td></tr></table>	11.93	(75)
0.77																			
1																			
41.38																			
0.52																			
0.8																			
11.93																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.99</td></tr></table>	0.99	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>19.39</td></tr></table>	19.39	(75)
0.77																			
0.99																			
67.96																			
0.52																			
0.8																			
19.39																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1</td></tr></table>	1	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>19.59</td></tr></table>	19.59	(75)
0.77																			
1																			
67.96																			
0.52																			
0.8																			
19.59																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.99</td></tr></table>	0.99	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>26.07</td></tr></table>	26.07	(75)
0.77																			
0.99																			
91.35																			
0.52																			
0.8																			
26.07																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1</td></tr></table>	1	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>26.33</td></tr></table>	26.33	(75)
0.77																			
1																			
91.35																			
0.52																			
0.8																			
26.33																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.99</td></tr></table>	0.99	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>27.79</td></tr></table>	27.79	(75)
0.77																			
0.99																			
97.38																			
0.52																			
0.8																			
27.79																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1</td></tr></table>	1	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>28.07</td></tr></table>	28.07	(75)
0.77																			
1																			
97.38																			
0.52																			
0.8																			
28.07																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.99</td></tr></table>	0.99	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>26</td></tr></table>	26	(75)
0.77																			
0.99																			
91.1																			
0.52																			
0.8																			
26																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1</td></tr></table>	1	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>26.26</td></tr></table>	26.26	(75)
0.77																			
1																			
91.1																			
0.52																			
0.8																			
26.26																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.99</td></tr></table>	0.99	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>20.73</td></tr></table>	20.73	(75)
0.77																			
0.99																			
72.63																			
0.52																			
0.8																			
20.73																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1</td></tr></table>	1	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>20.94</td></tr></table>	20.94	(75)
0.77																			
1																			
72.63																			
0.52																			
0.8																			
20.94																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.99</td></tr></table>	0.99	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>14.39</td></tr></table>	14.39	(75)
0.77																			
0.99																			
50.42																			
0.52																			
0.8																			
14.39																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1</td></tr></table>	1	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>14.54</td></tr></table>	14.54	(75)
0.77																			
1																			
50.42																			
0.52																			
0.8																			
14.54																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.99</td></tr></table>	0.99	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>8.01</td></tr></table>	8.01	(75)
0.77																			
0.99																			
28.07																			
0.52																			
0.8																			
8.01																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1</td></tr></table>	1	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>8.09</td></tr></table>	8.09	(75)
0.77																			
1																			
28.07																			
0.52																			
0.8																			
8.09																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.99</td></tr></table>	0.99	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>4.05</td></tr></table>	4.05	(75)
0.77																			
0.99																			
14.2																			
0.52																			
0.8																			
4.05																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1</td></tr></table>	1	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.52</td></tr></table>	0.52	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>4.09</td></tr></table>	4.09	(75)
0.77																			
1																			
14.2																			
0.52																			
0.8																			
4.09																			

DER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	0.99	x	9.21	x	0.52	x	0.8	=	2.63	(75)
Northeast 0.9x	0.77	x	1	x	9.21	x	0.52	x	0.8	=	2.66	(75)
Southeast 0.9x	0.77	x	0.7	x	36.79	x	0.52	x	0.8	=	14.85	(77)
Southeast 0.9x	0.77	x	2.4	x	36.79	x	0.52	x	0.8	=	50.91	(77)
Southeast 0.9x	0.77	x	7.2	x	36.79	x	0.52	x	0.8	=	76.37	(77)
Southeast 0.9x	0.77	x	0.7	x	62.67	x	0.52	x	0.8	=	25.3	(77)
Southeast 0.9x	0.77	x	2.4	x	62.67	x	0.52	x	0.8	=	86.73	(77)
Southeast 0.9x	0.77	x	7.2	x	62.67	x	0.52	x	0.8	=	130.09	(77)
Southeast 0.9x	0.77	x	0.7	x	85.75	x	0.52	x	0.8	=	34.61	(77)
Southeast 0.9x	0.77	x	2.4	x	85.75	x	0.52	x	0.8	=	118.66	(77)
Southeast 0.9x	0.77	x	7.2	x	85.75	x	0.52	x	0.8	=	177.99	(77)
Southeast 0.9x	0.77	x	0.7	x	106.25	x	0.52	x	0.8	=	42.88	(77)
Southeast 0.9x	0.77	x	2.4	x	106.25	x	0.52	x	0.8	=	147.03	(77)
Southeast 0.9x	0.77	x	7.2	x	106.25	x	0.52	x	0.8	=	220.54	(77)
Southeast 0.9x	0.77	x	0.7	x	119.01	x	0.52	x	0.8	=	48.03	(77)
Southeast 0.9x	0.77	x	2.4	x	119.01	x	0.52	x	0.8	=	164.68	(77)
Southeast 0.9x	0.77	x	7.2	x	119.01	x	0.52	x	0.8	=	247.03	(77)
Southeast 0.9x	0.77	x	0.7	x	118.15	x	0.52	x	0.8	=	47.69	(77)
Southeast 0.9x	0.77	x	2.4	x	118.15	x	0.52	x	0.8	=	163.49	(77)
Southeast 0.9x	0.77	x	7.2	x	118.15	x	0.52	x	0.8	=	245.24	(77)
Southeast 0.9x	0.77	x	0.7	x	113.91	x	0.52	x	0.8	=	45.97	(77)
Southeast 0.9x	0.77	x	2.4	x	113.91	x	0.52	x	0.8	=	157.63	(77)
Southeast 0.9x	0.77	x	7.2	x	113.91	x	0.52	x	0.8	=	236.44	(77)
Southeast 0.9x	0.77	x	0.7	x	104.39	x	0.52	x	0.8	=	42.13	(77)
Southeast 0.9x	0.77	x	2.4	x	104.39	x	0.52	x	0.8	=	144.45	(77)
Southeast 0.9x	0.77	x	7.2	x	104.39	x	0.52	x	0.8	=	216.68	(77)
Southeast 0.9x	0.77	x	0.7	x	92.85	x	0.52	x	0.8	=	37.48	(77)
Southeast 0.9x	0.77	x	2.4	x	92.85	x	0.52	x	0.8	=	128.49	(77)
Southeast 0.9x	0.77	x	7.2	x	92.85	x	0.52	x	0.8	=	192.73	(77)
Southeast 0.9x	0.77	x	0.7	x	69.27	x	0.52	x	0.8	=	27.96	(77)
Southeast 0.9x	0.77	x	2.4	x	69.27	x	0.52	x	0.8	=	95.85	(77)
Southeast 0.9x	0.77	x	7.2	x	69.27	x	0.52	x	0.8	=	143.78	(77)
Southeast 0.9x	0.77	x	0.7	x	44.07	x	0.52	x	0.8	=	17.79	(77)
Southeast 0.9x	0.77	x	2.4	x	44.07	x	0.52	x	0.8	=	60.98	(77)
Southeast 0.9x	0.77	x	7.2	x	44.07	x	0.52	x	0.8	=	91.48	(77)
Southeast 0.9x	0.77	x	0.7	x	31.49	x	0.52	x	0.8	=	12.71	(77)
Southeast 0.9x	0.77	x	2.4	x	31.49	x	0.52	x	0.8	=	43.57	(77)
Southeast 0.9x	0.77	x	7.2	x	31.49	x	0.52	x	0.8	=	65.36	(77)
Southwest 0.9x	0.77	x	9.6	x	36.79		0.52	x	0.8	=	101.83	(79)
Southwest 0.9x	0.77	x	8.88	x	36.79		0.52	x	0.8	=	94.19	(79)
Southwest 0.9x	0.77	x	8.4	x	36.79		0.52	x	0.8	=	89.1	(79)

DER WorkSheet: New dwelling design stage

Southwest0.9x	0.77	x	7.77	x	36.79	0.52	x	0.8	=	82.42	(79)
Southwest0.9x	0.77	x	0.72	x	36.79	0.52	x	0.8	=	7.64	(79)
Southwest0.9x	0.77	x	9.6	x	62.67	0.52	x	0.8	=	173.45	(79)
Southwest0.9x	0.77	x	8.88	x	62.67	0.52	x	0.8	=	160.44	(79)
Southwest0.9x	0.77	x	8.4	x	62.67	0.52	x	0.8	=	151.77	(79)
Southwest0.9x	0.77	x	7.77	x	62.67	0.52	x	0.8	=	140.39	(79)
Southwest0.9x	0.77	x	0.72	x	62.67	0.52	x	0.8	=	13.01	(79)
Southwest0.9x	0.77	x	9.6	x	85.75	0.52	x	0.8	=	237.33	(79)
Southwest0.9x	0.77	x	8.88	x	85.75	0.52	x	0.8	=	219.53	(79)
Southwest0.9x	0.77	x	8.4	x	85.75	0.52	x	0.8	=	207.66	(79)
Southwest0.9x	0.77	x	7.77	x	85.75	0.52	x	0.8	=	192.09	(79)
Southwest0.9x	0.77	x	0.72	x	85.75	0.52	x	0.8	=	17.8	(79)
Southwest0.9x	0.77	x	9.6	x	106.25	0.52	x	0.8	=	294.06	(79)
Southwest0.9x	0.77	x	8.88	x	106.25	0.52	x	0.8	=	272	(79)
Southwest0.9x	0.77	x	8.4	x	106.25	0.52	x	0.8	=	257.3	(79)
Southwest0.9x	0.77	x	7.77	x	106.25	0.52	x	0.8	=	238	(79)
Southwest0.9x	0.77	x	0.72	x	106.25	0.52	x	0.8	=	22.05	(79)
Southwest0.9x	0.77	x	9.6	x	119.01	0.52	x	0.8	=	329.37	(79)
Southwest0.9x	0.77	x	8.88	x	119.01	0.52	x	0.8	=	304.67	(79)
Southwest0.9x	0.77	x	8.4	x	119.01	0.52	x	0.8	=	288.2	(79)
Southwest0.9x	0.77	x	7.77	x	119.01	0.52	x	0.8	=	266.58	(79)
Southwest0.9x	0.77	x	0.72	x	119.01	0.52	x	0.8	=	24.7	(79)
Southwest0.9x	0.77	x	9.6	x	118.15	0.52	x	0.8	=	326.99	(79)
Southwest0.9x	0.77	x	8.88	x	118.15	0.52	x	0.8	=	302.46	(79)
Southwest0.9x	0.77	x	8.4	x	118.15	0.52	x	0.8	=	286.11	(79)
Southwest0.9x	0.77	x	7.77	x	118.15	0.52	x	0.8	=	264.66	(79)
Southwest0.9x	0.77	x	0.72	x	118.15	0.52	x	0.8	=	24.52	(79)
Southwest0.9x	0.77	x	9.6	x	113.91	0.52	x	0.8	=	315.25	(79)
Southwest0.9x	0.77	x	8.88	x	113.91	0.52	x	0.8	=	291.61	(79)
Southwest0.9x	0.77	x	8.4	x	113.91	0.52	x	0.8	=	275.84	(79)
Southwest0.9x	0.77	x	7.77	x	113.91	0.52	x	0.8	=	255.16	(79)
Southwest0.9x	0.77	x	0.72	x	113.91	0.52	x	0.8	=	23.64	(79)
Southwest0.9x	0.77	x	9.6	x	104.39	0.52	x	0.8	=	288.91	(79)
Southwest0.9x	0.77	x	8.88	x	104.39	0.52	x	0.8	=	267.24	(79)
Southwest0.9x	0.77	x	8.4	x	104.39	0.52	x	0.8	=	252.79	(79)
Southwest0.9x	0.77	x	7.77	x	104.39	0.52	x	0.8	=	233.83	(79)
Southwest0.9x	0.77	x	0.72	x	104.39	0.52	x	0.8	=	21.67	(79)
Southwest0.9x	0.77	x	9.6	x	92.85	0.52	x	0.8	=	256.97	(79)
Southwest0.9x	0.77	x	8.88	x	92.85	0.52	x	0.8	=	237.7	(79)
Southwest0.9x	0.77	x	8.4	x	92.85	0.52	x	0.8	=	224.85	(79)
Southwest0.9x	0.77	x	7.77	x	92.85	0.52	x	0.8	=	207.99	(79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	0.72	x	92.85	0.52	x	0.8	=	19.27	(79)	
Southwest	0.9x	0.77	x	9.6	x	69.27	0.52	x	0.8	=	191.7	(79)	
Southwest	0.9x	0.77	x	8.88	x	69.27	0.52	x	0.8	=	177.32	(79)	
Southwest	0.9x	0.77	x	8.4	x	69.27	0.52	x	0.8	=	167.74	(79)	
Southwest	0.9x	0.77	x	7.77	x	69.27	0.52	x	0.8	=	155.16	(79)	
Southwest	0.9x	0.77	x	0.72	x	69.27	0.52	x	0.8	=	14.38	(79)	
Southwest	0.9x	0.77	x	9.6	x	44.07	0.52	x	0.8	=	121.97	(79)	
Southwest	0.9x	0.77	x	8.88	x	44.07	0.52	x	0.8	=	112.82	(79)	
Southwest	0.9x	0.77	x	8.4	x	44.07	0.52	x	0.8	=	106.72	(79)	
Southwest	0.9x	0.77	x	7.77	x	44.07	0.52	x	0.8	=	98.72	(79)	
Southwest	0.9x	0.77	x	0.72	x	44.07	0.52	x	0.8	=	9.15	(79)	
Southwest	0.9x	0.77	x	9.6	x	31.49	0.52	x	0.8	=	87.14	(79)	
Southwest	0.9x	0.77	x	8.88	x	31.49	0.52	x	0.8	=	80.61	(79)	
Southwest	0.9x	0.77	x	8.4	x	31.49	0.52	x	0.8	=	76.25	(79)	
Southwest	0.9x	0.77	x	7.77	x	31.49	0.52	x	0.8	=	70.53	(79)	
Southwest	0.9x	0.77	x	0.72	x	31.49	0.52	x	0.8	=	6.54	(79)	
Northwest	0.9x	0.77	x	2.3	x	11.28	x	0.52	x	0.8	=	7.48	(81)
Northwest	0.9x	0.77	x	1.65	x	11.28	x	0.52	x	0.8	=	5.37	(81)
Northwest	0.9x	0.77	x	1.74	x	11.28	x	0.52	x	0.8	=	5.66	(81)
Northwest	0.9x	0.77	x	3.92	x	11.28	x	0.52	x	0.8	=	12.75	(81)
Northwest	0.9x	0.77	x	2.3	x	22.97	x	0.52	x	0.8	=	15.23	(81)
Northwest	0.9x	0.77	x	1.65	x	22.97	x	0.52	x	0.8	=	10.92	(81)
Northwest	0.9x	0.77	x	1.74	x	22.97	x	0.52	x	0.8	=	11.52	(81)
Northwest	0.9x	0.77	x	3.92	x	22.97	x	0.52	x	0.8	=	25.95	(81)
Northwest	0.9x	0.77	x	2.3	x	41.38	x	0.52	x	0.8	=	27.44	(81)
Northwest	0.9x	0.77	x	1.65	x	41.38	x	0.52	x	0.8	=	19.68	(81)
Northwest	0.9x	0.77	x	1.74	x	41.38	x	0.52	x	0.8	=	20.76	(81)
Northwest	0.9x	0.77	x	3.92	x	41.38	x	0.52	x	0.8	=	46.76	(81)
Northwest	0.9x	0.77	x	2.3	x	67.96	x	0.52	x	0.8	=	45.06	(81)
Northwest	0.9x	0.77	x	1.65	x	67.96	x	0.52	x	0.8	=	32.32	(81)
Northwest	0.9x	0.77	x	1.74	x	67.96	x	0.52	x	0.8	=	34.09	(81)
Northwest	0.9x	0.77	x	3.92	x	67.96	x	0.52	x	0.8	=	76.8	(81)
Northwest	0.9x	0.77	x	2.3	x	91.35	x	0.52	x	0.8	=	60.57	(81)
Northwest	0.9x	0.77	x	1.65	x	91.35	x	0.52	x	0.8	=	43.45	(81)
Northwest	0.9x	0.77	x	1.74	x	91.35	x	0.52	x	0.8	=	45.82	(81)
Northwest	0.9x	0.77	x	3.92	x	91.35	x	0.52	x	0.8	=	103.23	(81)
Northwest	0.9x	0.77	x	2.3	x	97.38	x	0.52	x	0.8	=	64.57	(81)
Northwest	0.9x	0.77	x	1.65	x	97.38	x	0.52	x	0.8	=	46.32	(81)
Northwest	0.9x	0.77	x	1.74	x	97.38	x	0.52	x	0.8	=	48.85	(81)
Northwest	0.9x	0.77	x	3.92	x	97.38	x	0.52	x	0.8	=	110.05	(81)
Northwest	0.9x	0.77	x	2.3	x	91.1	x	0.52	x	0.8	=	60.41	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	1.65	x	91.1	x	0.52	x	0.8	=	43.33	(81)
Northwest 0.9x	0.77	x	1.74	x	91.1	x	0.52	x	0.8	=	45.7	(81)
Northwest 0.9x	0.77	x	3.92	x	91.1	x	0.52	x	0.8	=	102.95	(81)
Northwest 0.9x	0.77	x	2.3	x	72.63	x	0.52	x	0.8	=	48.16	(81)
Northwest 0.9x	0.77	x	1.65	x	72.63	x	0.52	x	0.8	=	34.55	(81)
Northwest 0.9x	0.77	x	1.74	x	72.63	x	0.52	x	0.8	=	36.43	(81)
Northwest 0.9x	0.77	x	3.92	x	72.63	x	0.52	x	0.8	=	82.07	(81)
Northwest 0.9x	0.77	x	2.3	x	50.42	x	0.52	x	0.8	=	33.43	(81)
Northwest 0.9x	0.77	x	1.65	x	50.42	x	0.52	x	0.8	=	23.98	(81)
Northwest 0.9x	0.77	x	1.74	x	50.42	x	0.52	x	0.8	=	25.29	(81)
Northwest 0.9x	0.77	x	3.92	x	50.42	x	0.52	x	0.8	=	56.98	(81)
Northwest 0.9x	0.77	x	2.3	x	28.07	x	0.52	x	0.8	=	18.61	(81)
Northwest 0.9x	0.77	x	1.65	x	28.07	x	0.52	x	0.8	=	13.35	(81)
Northwest 0.9x	0.77	x	1.74	x	28.07	x	0.52	x	0.8	=	14.08	(81)
Northwest 0.9x	0.77	x	3.92	x	28.07	x	0.52	x	0.8	=	31.72	(81)
Northwest 0.9x	0.77	x	2.3	x	14.2	x	0.52	x	0.8	=	9.41	(81)
Northwest 0.9x	0.77	x	1.65	x	14.2	x	0.52	x	0.8	=	6.75	(81)
Northwest 0.9x	0.77	x	1.74	x	14.2	x	0.52	x	0.8	=	7.12	(81)
Northwest 0.9x	0.77	x	3.92	x	14.2	x	0.52	x	0.8	=	16.04	(81)
Northwest 0.9x	0.77	x	2.3	x	9.21	x	0.52	x	0.8	=	6.11	(81)
Northwest 0.9x	0.77	x	1.65	x	9.21	x	0.52	x	0.8	=	4.38	(81)
Northwest 0.9x	0.77	x	1.74	x	9.21	x	0.52	x	0.8	=	4.62	(81)
Northwest 0.9x	0.77	x	3.92	x	9.21	x	0.52	x	0.8	=	10.41	(81)
Rooflights 0.9x	1	x	2.24	x	26	x	0.45	x	0.8	=	56.61	(82)
Rooflights 0.9x	1	x	1	x	26	x	0.45	x	0.8	=	8.42	(82)
Rooflights 0.9x	1	x	2.24	x	54	x	0.45	x	0.8	=	117.57	(82)
Rooflights 0.9x	1	x	1	x	54	x	0.45	x	0.8	=	17.5	(82)
Rooflights 0.9x	1	x	2.24	x	96	x	0.45	x	0.8	=	209.02	(82)
Rooflights 0.9x	1	x	1	x	96	x	0.45	x	0.8	=	31.1	(82)
Rooflights 0.9x	1	x	2.24	x	150	x	0.45	x	0.8	=	326.59	(82)
Rooflights 0.9x	1	x	1	x	150	x	0.45	x	0.8	=	48.6	(82)
Rooflights 0.9x	1	x	2.24	x	192	x	0.45	x	0.8	=	418.04	(82)
Rooflights 0.9x	1	x	1	x	192	x	0.45	x	0.8	=	62.21	(82)
Rooflights 0.9x	1	x	2.24	x	200	x	0.45	x	0.8	=	435.46	(82)
Rooflights 0.9x	1	x	1	x	200	x	0.45	x	0.8	=	64.8	(82)
Rooflights 0.9x	1	x	2.24	x	189	x	0.45	x	0.8	=	411.51	(82)
Rooflights 0.9x	1	x	1	x	189	x	0.45	x	0.8	=	61.24	(82)
Rooflights 0.9x	1	x	2.24	x	157	x	0.45	x	0.8	=	341.83	(82)
Rooflights 0.9x	1	x	1	x	157	x	0.45	x	0.8	=	50.87	(82)
Rooflights 0.9x	1	x	2.24	x	115	x	0.45	x	0.8	=	250.39	(82)
Rooflights 0.9x	1	x	1	x	115	x	0.45	x	0.8	=	37.26	(82)

DER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	2.24	x	66	x	0.45	x	0.8	=	143.7	(82)
Rooflights 0.9x	1	x	1	x	66	x	0.45	x	0.8	=	21.38	(82)
Rooflights 0.9x	1	x	2.24	x	33	x	0.45	x	0.8	=	71.85	(82)
Rooflights 0.9x	1	x	1	x	33	x	0.45	x	0.8	=	10.69	(82)
Rooflights 0.9x	1	x	2.24	x	21	x	0.45	x	0.8	=	45.72	(82)
Rooflights 0.9x	1	x	1	x	21	x	0.45	x	0.8	=	6.8	(82)

Solar gains in watts, calculated for each month

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

(83)m=	620.08	1093.05	1584.16	2096.32	2458.99	2487.09	2378.94	2103.28	1761.74	1232.83	749.64	526.05	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1216.56	1687.25	2158.52	2638.05	2966.41	2937.31	2808.77	2539.8	2215.48	1744.46	1299.13	1105.06	(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	0.97	0.9	0.77	0.61	0.46	0.52	0.77	0.95	0.99	1	(86)

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

(87)m=	19.6	19.81	20.13	20.48	20.75	20.88	20.92	20.91	20.8	20.42	19.92	19.56	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.6	19.6	19.61	19.62	19.62	19.63	19.63	19.63	19.62	19.62	19.61	19.61	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.87	0.7	0.5	0.32	0.38	0.67	0.93	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=	17.76	18.08	18.53	19.03	19.36	19.5	19.52	19.52	19.43	18.96	18.25	17.71	(90)
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fLA = Living area ÷ (4) =

0.45

(91)

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

(92)m=	18.59	18.87	19.26	19.69	20	20.13	20.16	20.15	20.06	19.62	19.01	18.55	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.59	18.87	19.26	19.69	20	20.13	20.16	20.15	20.06	19.62	19.01	18.55	(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=	0.99	0.98	0.95	0.87	0.73	0.54	0.38	0.43	0.71	0.93	0.99	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	1210.37	1659.1	2055.56	2299.93	2151.19	1579.26	1054.03	1100.18	1563.28	1621.51	1283.61	1101.12	(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=	4386.79	4279.47	3901.5	3273.31	2511.38	1661.17	1069.07	1126.29	1794.77	2732.38	3616.82	4372.77	(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=	2363.26	1760.89	1373.38	700.84	267.98	0	0	0	0	826.49	1679.91	2434.1	
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DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 11406.84 (98)

Space heating requirement in kWh/m²/year 60.04 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 466.13 (206)

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

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

2363.26	1760.89	1373.38	700.84	267.98	0	0	0	0	826.49	1679.91	2434.1
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(211)m = {[(98)m × (204)] } × 100 ÷ (206) (211)

507	377.77	294.64	150.35	57.49	0	0	0	0	177.31	360.4	522.2
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Total (kWh/year) = Sum(211)_{1...5,10...12} = 2447.15 (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
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Total (kWh/year) = Sum(215)_{1...5,10...12} = 0 (215)

Water heating

Output from water heater (calculated above)

225.82	199.05	209.09	187.49	183.78	0	0	0	0	194.42	205.5	220.4
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Efficiency of water heater 190.32 (216)

(217)m= 190.32 190.32 190.32 190.32 190.32 190.32 190.32 190.32 190.32 190.32 190.32 190.32 (217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=

118.65	104.59	109.86	98.51	96.56	0	0	0	0	102.15	107.98	115.81
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Total = Sum(219a)_{1...12} = 854.12 (219)

Water heating requirement (immersion)

0	0	0	0	0	141.76	134.56	149.84	150.26	0	0	0
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Efficiency of water heater (Immersion) 100 (216)

(217)m= 0 0 0 0 0 100 100 100 100 0 0 0 (217)

Fuel for water heating (Immersion), kWh/month

(219)m = [(64)m + (218) m] × 100 ÷ (217)m

(219)m=

0	0	0	0	0	141.76	134.56	149.84	150.26	0	0	0
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Total = Sum(219a)_{1...12} = 576.41 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year kWh/year

2447.15

Water heating fuel used

854.12

Water heating fuel used (Immersion)

576.41

Electricity for pumps, fans and electric keep-hot

Total electricity for the above, kWh/year sum of (230a)...(230g) = 0 (231)

DER WorkSheet: New dwelling design stage

Electricity for lighting	569.05	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =	3870.31	(338)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	1270.07	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	443.29	(264)
Water heating (Immersion)	(219) x	0.519	=	299.16	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2012.51	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0	(267)
Electricity for lighting	(232) x	0.519	=	295.33	(268)
Total CO2, kg/year		sum of (265)...(271) =		2307.85	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		12.15	(273)
El rating (section 14)				87	(274)

Building Regulations Approved Document Part G (2010) & Sustainability Statement



PROJECT DETAILS

Project Reference: 2239

Client: Elegant Homes (Caversham) Ltd

Site address: 5 Grass Hill, Caversham, Reading, RG4 7TJ

Assessor: Antony Straszewski

Company: Proport Eco-Services www.proporteco.co.uk

Tel: 01439 788 680

Prepared on: 18th August 2021

SUMMARY

Following the Government's national calculation methodology for assessing water efficiency in new dwellings, the dwellings, as designed, will achieve a water consumption of 109.1 litres per person per day. Key elements of the design include: dual flush WC's, low flow taps & showers and low capacity baths.

Compliance with the requirements of G2 of Schedule 1 and Regulation 36 to the Building Regulations 2010, as amended, has been demonstrated. In addition, the design meets the optional requirements of Regulations 36(3) for water consumption to be limited to 110 litres per person per day.

Introduction

This report relates to the construction of two detached dwellings at 5 Grass Hill, Reading. Reading Borough Council planning Ref: 201233.

Calculations

Based on information supplied by the client/architect. No multiple fitting types (basic calculation methodology used).

Table 1: The Water Calculator for New Dwellings					
Installation Type	Unit of Measure	Capacity/ flow rate	Use Factor	Fixed Use (L/person/day)	L/person/day
WC (single flush)	Flush volume (litres)	---	4.42	0.00	---
WC (dual flush)	Full flush vol.	4.0	1.46	0.00	13.4
	Part flush vol.	2.6	2.96	0.00	
WC (multiple fittings)	Average effective flush vol. (litres)	---	4.42	0.00	---
Taps (excl. kitchen/utility)	Flow rate (litres/min)	4.0	1.58	1.58	7.90
Bath (shower also present)	Capacity to overflow (litres)	180	0.11	0.00	19.80
Shower (bath also present)	Flow rate (litres/min)	9.0	4.37	0.00	39.33
Bath only	Capacity to overflow (litres)	---	0.5	0.00	---
Shower only	Flow rate (litres/min)	---	5.60	0.00	---
Kitchen/utility sink taps	Flow rate (litres/min)	4.0	0.44	10.36	12.12
Washing machine	Litres/kg dry load	8.17	2.1	0.00	17.16
Dishwasher	Litres/place setting	1.25	3.6	0.00	4.50
Waste disposal	Litres/use	If present = 1 If absent = 0	3.08	0.00	---
Water softener	Litres/person/day	Table 3.	1.00	0.00	---
Total calculated use (litres/person/day)					114.3
Contribution from greywater (litres/person/day) from Table 4.6					0.00
Contribution from rainwater (litres/person/day) from Table 5.5					0.00
Normalisation factor					0.91
Total internal water consumption (litres/person/day)					104.1
External water use					5.0
Total water consumption (Building Regulation 17.K) (litres/person/day)					109.1
17.K Compliance?					Yes

Default values used for dishwasher and washing machine.

No multiple fitting types (basic calculation methodology used), Table 2 not required.

No water softener specified, Table 3 not required.

Greywater and rainwater recycling systems not installed, Tables 4 and 5 not required.

This is a Design Stage calculation and is based on the Design Stage specification provided by the client/architect.

Additional Notes:

Reference should be made to Section 1 *The Water Calculator Methodology* of The Water Efficiency Calculator for new dwellings, DCLG, 2009.

Taps: flow rates are measured at a dynamic pressure of 3 ± 0.2 bar for high pressure taps or at a dynamic pressure of 0.1 ± 0.02 bar for low pressure taps. Taps for filling baths are not included as these are taken account of in the use factor for baths.

Baths: total capacity of the bath to the overflow.

Showers: flow rates are measured using cold water at a dynamic pressure of 3 ± 0.2 bar for high pressure systems or at a dynamic pressure of 0.1 ± 0.05 bar for low pressure systems.