

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.5.0.81
Printed on 27 January 2015 at 12:14:38

Project Information:

Assessed By: () **Building Type:** Detached Bungalow

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Pen Y Gaer **Plot Reference:** Pen Y Gaer Revised

Address :

Client Details:

Name:

Address :

**This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.**

1 TER and DER

Fuel for main heating system: Oil

Fuel factor: 1.17 (oil)

Target Carbon Dioxide Emission Rate (TER) 20.75 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 19.57 kg/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.15 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.72 (max. 2.00)	2.00 (max. 3.30)	OK

3 Air permeability

Air permeability at 50 pascals	5.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 372, product index 016550): Boiler system with radiators or underfloor - heating oil Brand name: Grant Model: Vortex 26-36 Boilerhouse System Model qualifier: (Regular boiler) Efficiency 93.3 % SEDBUK2009 Minimum 80.0 %	OK
Secondary heating system:	Room heaters - wood Closed room heater Efficiency 65.0 % Minimum 65.0 %	OK

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.01 kWh/day Permitted by DBSCG: 2.30 kWh/day	
Primary pipework insulated:	Yes	OK

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6 Controls

Space heating controls	Time and temperature zone control	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Wales):	Not assessed	?
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10 Key features

Thermal bridging	0.02
Roofs U-value	0.09 W/m²K
Floors U-value	0.19 W/m²K
Secondary heating, wood logs	

DRAFT

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2009

Software Version:

Version: 1.5.0.81

Property Address: Pen Y Gaer Revised

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Ave Height(m)		Volume(m ³)
Ground floor	95.8 (1a)	x	2.3 (2a)	=	220.34 (3a)
First floor	95.8 (1b)	x	2.3 (2b)	=	220.34 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	191.600006103516 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	440.68 (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							3	x 10 =	30 (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) =							30	÷ (5) =	0.07 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)									
Number of storeys in the dwelling (ns)									0 (9)
Additional infiltration								[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction									0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35									
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0									0 (12)
If no draught lobby, enter 0.05, else enter 0									0 (13)
Percentage of windows and doors draught stripped									0 (14)
Window infiltration							0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate							(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area									5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)									0.32 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used									
Number of sides on which sheltered									2 (19)
Shelter factor							(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor							(21) = (18) x (20) =		0.27 (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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.36	0.34	0.34	0.3	0.28	0.26	0.25	0.25	0.28	0.3	0.32	0.34
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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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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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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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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 × 0.5]

(24d)m=	0.57	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.55	0.55	0.56
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.55	0.55	0.56
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors Type 1			2.1	x 2	= 4.2		(26)
Doors Type 2			2.1	x 2	= 4.2		(26)
Doors Type 3			2.1	x 2	= 4.2		(26)
Windows Type 1			6.69	x1/[1/(1.6)+ 0.04] =	10.06		(27)
Windows Type 2			5.57	x1/[1/(1.6)+ 0.04] =	8.38		(27)
Windows Type 3			1.08	x1/[1/(1.6)+ 0.04] =	1.62		(27)
Windows Type 4			1.26	x1/[1/(1.6)+ 0.04] =	1.89		(27)
Floor			95.8	x 0.19	= 18.2		(28)
Walls Type1	283.45	20.9	262.55	x 0.24	= 63.01		(29)
Walls Type2	35.88	0	35.88	x 0.24	= 8.61		(29)
Roof Type1	61.54	0	61.54	x 0.2	= 12.31		(30)
Roof Type2	35.55	0	35.55	x 0.09	= 3.2		(30)
Roof Type3	15	0	15	x 0.09	= 1.35		(30)
Total area of elements, m²			527.220016479492				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 141.24 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 51252.2321813107 (34)

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

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

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can be used instead of a detailed calculation.

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

9.2 (36)

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

Total fabric heat loss

(33) + (36) =

150.44 (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=	82.4	81.35	81.35	79.44	78.3	77.76	77.26	77.26	78.57	79.44	80.37	81.35

(38)

Heat transfer coefficient, W/K

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

(39)m=	232.84	231.79	231.79	229.88	228.73	228.2	227.7	227.7	229.01	229.88	230.8	231.79
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Average = Sum(39)_{1...12} / 12 =

230.01 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.22	1.21	1.21	1.2	1.19	1.19	1.19	1.19	1.2	1.2	1.2	1.21
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Average = Sum(40)_{1...12} / 12 =

1.2 (40)

Number of days in month (Table 1a)

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

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

if TFA ≤ 13.9, N = 1

2.99 (42)

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

105.24 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	115.76	111.55	107.34	103.13	98.92	94.71	94.71	98.92	103.13	107.34	111.55	115.76
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Total = Sum(44)_{1...12} =

1262.83 (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=	172.08	150.5	155.3	135.4	129.92	112.11	103.88	119.21	120.63	140.59	153.46	166.65
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Total = Sum(45)_{1...12} =

1659.73 (45)

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

(46)m=	25.81	22.58	23.3	20.31	19.49	16.82	15.58	17.88	18.09	21.09	23.02	25
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(46)

Water storage loss:

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

0 (47)

Temperature factor from Table 2b

0 (48)

Energy lost from water storage, kWh/year

(47) x (48) =

0 (49)

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

Cylinder volume (litres) including any solar storage within same

210 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

0.01 (51)

Volume factor from Table 2a

0.83 (52)

Temperature factor from Table 2b

0.54 (53)

Energy lost from water storage, kWh/year

((50) x (51) x (52) x (53) =

1.09 (54)

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Enter (49) or (54) in (55)

1.09

(55)

Water storage loss calculated for each month

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

(56)m=

33.69	30.43	33.69	32.6	33.69	32.6	33.69	33.69	32.6	33.69	32.6	33.69
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(56)

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

(57)m=

33.69	30.43	33.69	32.6	33.69	32.6	33.69	33.69	32.6	33.69	32.6	33.69
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(57)

Primary circuit loss (annual) from Table 3

360

(58)

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

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

(59)m=

30.58	27.62	30.58	29.59	30.58	29.59	30.58	30.58	29.59	30.58	29.59	30.58
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(59)

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

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0
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(61)

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

(62)m=

236.34	208.54	219.57	197.59	194.18	174.3	168.15	183.47	182.82	204.85	215.65	230.91
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(62)

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

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

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
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(63)

Output from water heater

(64)m=

236.34	208.54	219.57	197.59	194.18	174.3	168.15	183.47	182.82	204.85	215.65	230.91
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Output from water heater (annual) 1.12

2416.36

(64)

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

(65)m=

108.63	96.48	103.05	94.77	94.61	87.03	85.95	91.05	89.86	98.15	100.78	106.82
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(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
179.46	179.46	179.46	179.46	179.46	179.46	179.46	179.46	179.46	179.46	179.46	179.46

(66)

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

(67)m=

98.53	87.51	71.17	53.88	40.28	34	36.74	47.76	64.1	81.39	95	101.27
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(67)

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

(68)m=

541.78	547.4	533.23	503.07	465	429.22	405.31	399.69	413.86	444.02	482.09	517.87
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(68)

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

(69)m=

55.94	55.94	55.94	55.94	55.94	55.94	55.94	55.94	55.94	55.94	55.94	55.94
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(69)

Pumps and fans gains (Table 5a)

(70)m=

20	20	20	20	20	20	20	20	20	20	20	20
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(70)

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

(71)m=

-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64
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(71)

Water heating gains (Table 5)

(72)m=

146	143.57	138.51	131.63	127.16	120.87	115.53	122.37	124.81	131.93	139.97	143.58
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(72)

Total internal gains =

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

(73)m=

922.07	914.24	878.67	824.34	768.19	719.85	693.34	705.58	738.52	793.09	852.81	898.47
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(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d			Area m ²	Flux Table 6a			g_ Table 6b	FF Table 6c			Gains (W)	
East	0.9x	1	x	1.26	x	19.87	x	0.63	x	0.7	=	7.65	(76)
East	0.9x	1	x	1.26	x	38.52	x	0.63	x	0.7	=	14.83	(76)
East	0.9x	1	x	1.26	x	61.57	x	0.63	x	0.7	=	23.71	(76)
East	0.9x	1	x	1.26	x	91.41	x	0.63	x	0.7	=	35.2	(76)
East	0.9x	1	x	1.26	x	111.22	x	0.63	x	0.7	=	42.83	(76)
East	0.9x	1	x	1.26	x	116.05	x	0.63	x	0.7	=	44.69	(76)
East	0.9x	1	x	1.26	x	112.64	x	0.63	x	0.7	=	43.38	(76)
East	0.9x	1	x	1.26	x	98.03	x	0.63	x	0.7	=	37.75	(76)
East	0.9x	1	x	1.26	x	73.6	x	0.63	x	0.7	=	28.34	(76)
East	0.9x	1	x	1.26	x	46.91	x	0.63	x	0.7	=	18.06	(76)
East	0.9x	1	x	1.26	x	24.71	x	0.63	x	0.7	=	9.51	(76)
East	0.9x	1	x	1.26	x	16.39	x	0.63	x	0.7	=	6.31	(76)
South	0.9x	0.77	x	6.69	x	47.32	x	0.63	x	0.7	=	96.75	(78)
South	0.9x	0.77	x	5.57	x	47.32	x	0.63	x	0.7	=	80.56	(78)
South	0.9x	0.77	x	6.69	x	77.18	x	0.63	x	0.7	=	157.81	(78)
South	0.9x	0.77	x	5.57	x	77.18	x	0.63	x	0.7	=	131.39	(78)
South	0.9x	0.77	x	6.69	x	94.25	x	0.63	x	0.7	=	192.69	(78)
South	0.9x	0.77	x	5.57	x	94.25	x	0.63	x	0.7	=	160.43	(78)
South	0.9x	0.77	x	6.69	x	105.11	x	0.63	x	0.7	=	214.91	(78)
South	0.9x	0.77	x	5.57	x	105.11	x	0.63	x	0.7	=	178.93	(78)
South	0.9x	0.77	x	6.69	x	108.55	x	0.63	x	0.7	=	221.94	(78)
South	0.9x	0.77	x	5.57	x	108.55	x	0.63	x	0.7	=	184.78	(78)
South	0.9x	0.77	x	6.69	x	108.9	x	0.63	x	0.7	=	222.65	(78)
South	0.9x	0.77	x	5.57	x	108.9	x	0.63	x	0.7	=	185.37	(78)
South	0.9x	0.77	x	6.69	x	107.14	x	0.63	x	0.7	=	219.05	(78)
South	0.9x	0.77	x	5.57	x	107.14	x	0.63	x	0.7	=	182.38	(78)
South	0.9x	0.77	x	6.69	x	103.88	x	0.63	x	0.7	=	212.39	(78)
South	0.9x	0.77	x	5.57	x	103.88	x	0.63	x	0.7	=	176.84	(78)
South	0.9x	0.77	x	6.69	x	99.99	x	0.63	x	0.7	=	204.44	(78)
South	0.9x	0.77	x	5.57	x	99.99	x	0.63	x	0.7	=	170.21	(78)
South	0.9x	0.77	x	6.69	x	85.29	x	0.63	x	0.7	=	174.38	(78)
South	0.9x	0.77	x	5.57	x	85.29	x	0.63	x	0.7	=	145.19	(78)
South	0.9x	0.77	x	6.69	x	56.07	x	0.63	x	0.7	=	114.64	(78)
South	0.9x	0.77	x	5.57	x	56.07	x	0.63	x	0.7	=	95.44	(78)
South	0.9x	0.77	x	6.69	x	40.89	x	0.63	x	0.7	=	83.6	(78)
South	0.9x	0.77	x	5.57	x	40.89	x	0.63	x	0.7	=	69.61	(78)
West	0.9x	0.77	x	1.08	x	19.87	x	0.63	x	0.7	=	6.56	(80)
West	0.9x	0.77	x	1.08	x	38.52	x	0.63	x	0.7	=	12.71	(80)
West	0.9x	0.77	x	1.08	x	61.57	x	0.63	x	0.7	=	20.32	(80)

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West	0.9x	0.77	x	1.08	x	91.41	x	0.63	x	0.7	=	30.17	(80)
West	0.9x	0.77	x	1.08	x	111.22	x	0.63	x	0.7	=	36.71	(80)
West	0.9x	0.77	x	1.08	x	116.05	x	0.63	x	0.7	=	38.3	(80)
West	0.9x	0.77	x	1.08	x	112.64	x	0.63	x	0.7	=	37.18	(80)
West	0.9x	0.77	x	1.08	x	98.03	x	0.63	x	0.7	=	32.36	(80)
West	0.9x	0.77	x	1.08	x	73.6	x	0.63	x	0.7	=	24.29	(80)
West	0.9x	0.77	x	1.08	x	46.91	x	0.63	x	0.7	=	15.48	(80)
West	0.9x	0.77	x	1.08	x	24.71	x	0.63	x	0.7	=	8.15	(80)
West	0.9x	0.77	x	1.08	x	16.39	x	0.63	x	0.7	=	5.41	(80)

Solar gains in watts, calculated for each month

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

(83)m=	191.52	316.74	397.15	459.21	486.25	491.01	481.98	459.34	427.28	353.12	227.75	164.93	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	1113.59	1230.97	1275.82	1283.55	1254.45	1210.86	1175.32	1164.92	1165.81	1146.21	1080.56	1063.41	(84)
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.99	0.97	0.9	0.72	0.73	0.92	0.98	1	1	(86)

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

(87)m=	19.68	19.8	20.02	20.24	20.56	20.82	20.96	20.96	20.78	20.41	19.95	19.71	(87)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.91	19.91	19.91	19.92	19.93	19.93	19.93	19.93	19.93	19.92	19.92	19.91	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.98	0.95	0.83	0.57	0.57	0.87	0.98	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(90)m=	18.15	18.33	18.65	18.98	19.44	19.78	19.92	19.92	19.73	19.23	18.56	18.2	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =

0.2 (91)

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

(92)m=	18.46	18.63	18.93	19.24	19.66	19.99	20.13	20.13	19.94	19.46	18.84	18.5	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(93)m=	18.31	18.48	18.78	19.09	19.51	19.84	19.98	19.98	19.79	19.31	18.69	18.35	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.99	0.98	0.94	0.82	0.58	0.58	0.86	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	1109.14	1222.6	1259.48	1253.69	1178.34	998.79	676.82	675.91	1002.01	1109.32	1072.83	1059.5	(95)
--------	---------	--------	---------	---------	---------	--------	--------	--------	---------	---------	---------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	3215.37	3123.38	2776.5	2387.91	1786.55	1195.68	700.38	700.23	1257.32	1957.15	2698.92	3117.61	(97)
--------	---------	---------	--------	---------	---------	---------	--------	--------	---------	---------	---------	---------	------

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

(98)m=	1567.03	1277.32	1128.67	816.64	452.5	0	0	0	0	630.79	1170.79	1531.23	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													8574.98 (98)

Space heating requirement in kWh/m²/year

44.75 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0.1 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

0.9 (202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

0.9 (204)

Efficiency of main space heating system 1

95.9 (206)

Efficiency of secondary/supplementary heating system, %

65 (208)

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

Space heating requirement (calculated above)

1567.03	1277.32	1128.67	816.64	452.5	0	0	0	0	630.79	1170.79	1531.23
---------	---------	---------	--------	-------	---	---	---	---	--------	---------	---------

(211)m = $\{[(98)m \times (204)] + (210)m\} \times 100 \div (206)$

(211)

1470.63	1198.74	1059.23	766.4	424.67	0	0	0	0	591.98	1098.76	1437.03
---------	---------	---------	-------	--------	---	---	---	---	--------	---------	---------

Total (kWh/year) = Sum(211)_{1...5,10...12} = 8047.43 (211)

Space heating fuel (secondary), kWh/month

= $\{[(98)m \times (201)] + (214)m\} \times 100 \div (208)$

(215)m=	241.08	196.51	173.64	125.64	69.62	0	0	0	0	97.04	180.12	235.57
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Total (kWh/year) = Sum(215)_{1...5,10...12} = 1319.23 (215)

Water heating

Output from water heater (calculated above)

236.34	208.54	219.57	197.59	194.18	174.3	168.15	183.47	182.82	204.85	215.65	230.91
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

82.7 (216)

(217)m=	92.52	92.39	92.08	91.65	90.28	82.7	82.7	82.7	82.7	90.99	92.18	92.52
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(217)

Fuel for water heating, kWh/month

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

(219)m=	255.44	225.71	238.44	215.58	215.09	210.76	203.32	221.85	221.07	225.14	233.93	249.57
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Total = Sum(219a)_{1...12} = 2715.92 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

8047.43

Space heating fuel used, secondary

1319.23

Water heating fuel used

2715.92

Electricity for pumps, fans and electric keep-hot

central heating pump:

130 (230c)

oil boiler pump

100 (230d)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 230 (231)

Electricity for lighting

696.04 (232)

10a. Fuel costs - individual heating systems:

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	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	4.06	x 0.01 = 326.725471565157 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	3.42	x 0.01 = 45.1175826760043 (242)
Water heating cost (other fuel)	(219)	4.06	x 0.01 = 110.27 (247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 = 26.36 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	11.46	x 0.01 = 79.77 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		588.233266632755 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.47 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.1685106854834 (257)
SAP rating (Section 12)		83.6992759375066 (258)

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	0.274	= 2204.99 (261)
Space heating (secondary)	(215) x	0.008	= 10.55 (263)
Water heating	(219) x	0.274	= 744.16 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2959.71 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	= 118.91 (267)
Electricity for lighting	(232) x	0.517	= 359.85 (268)
Total CO2, kg/year		sum of (265)...(271) =	3438.47 (272)
CO2 emissions per m²		(272) ÷ (4) =	17.95 (273)
EI rating (section 14)			81 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.06	= 8530.27 (261)
Space heating (secondary)	(215) x	1.05	= 1385.19 (263)
Energy for water heating	(219) x	1.06	= 2878.87 (264)
Space and water heating	(261) + (262) + (263) + (264) =		12794.33 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	= 671.6 (267)

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Electricity for lighting	(232) x	0	=	2032.43	(268)
'Total Primary Energy			sum of (265)...(271) =	15498.36	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =	80.89	(273)

DRAFT

Fabric Efficiency WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2009

Software Version:

Version: 1.5.0.81

Property Address: Pen Y Gaer Revised

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Ave Height(m)		Volume(m ³)
Ground floor	95.8 (1a)	x	2.3 (2a)	=	220.34 (3a)
First floor	95.8 (1b)	x	2.3 (2b)	=	220.34 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	191.600006103516 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	440.68 (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) =	0.09 (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)									0.34 (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 on which sheltered									2 (19)
Shelter factor							(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor							(21) = (18) x (20) =		0.29 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1
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Fabric Efficiency WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.39	0.37	0.37	0.33	0.3	0.28	0.27	0.27	0.3	0.33	0.35	0.37
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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 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= 0.58 0.57 0.57 0.55 0.54 0.54 0.54 0.54 0.55 0.55 0.56 0.57 (24d)

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors Type 1			2.1	x 2	= 4.2		(26)
Doors Type 2			2.1	x 2	= 4.2		(26)
Doors Type 3			2.1	x 2	= 4.2		(26)
Windows Type 1			6.69	x1/[1/(1.6)+ 0.04] =	10.06		(27)
Windows Type 2			5.57	x1/[1/(1.6)+ 0.04] =	8.38		(27)
Windows Type 3			1.08	x1/[1/(1.6)+ 0.04] =	1.62		(27)
Windows Type 4			1.26	x1/[1/(1.6)+ 0.04] =	1.89		(27)
Floor			95.8	x 0.19	= 18.2		(28)
Walls Type1	283.45	20.9	262.55	x 0.24	= 63.01		(29)
Walls Type2	35.88	0	35.88	x 0.24	= 8.61		(29)
Roof Type1	61.54	0	61.54	x 0.2	= 12.31		(30)
Roof Type2	35.55	0	35.55	x 0.09	= 3.2		(30)
Roof Type3	15	0	15	x 0.09	= 1.35		(30)
Total area of elements, m²			527.220016479492				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 141.24 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 51252.2321813107 (34)

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

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

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can be used instead of a detailed calculation.

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

9.2 (36)

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

Total fabric heat loss

(33) + (36) =

150.44 (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=	83.83	82.63	82.63	80.43	79.12	78.51	77.93	77.93	79.44	80.43	81.5	82.63

(38)

Heat transfer coefficient, W/K

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

(39)m=	234.27	233.07	233.07	230.87	229.56	228.95	228.37	228.37	229.88	230.87	231.93	233.07
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Average = Sum(39)_{1...12} / 12 =

231.02 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.22	1.22	1.22	1.2	1.2	1.19	1.19	1.19	1.2	1.2	1.21	1.22
--------	------	------	------	-----	-----	------	------	------	-----	-----	------	------

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

1.21 (40)

Number of days in month (Table 1a)

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

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

if TFA ≤ 13.9, N = 1

2.99 (42)

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

105.24 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	115.76	111.55	107.34	103.13	98.92	94.71	94.71	98.92	103.13	107.34	111.55	115.76
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Total = Sum(44)_{1...12} =

1262.83 (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=	172.08	150.5	155.3	135.4	129.92	112.11	103.88	119.21	120.63	140.59	153.46	166.65
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Total = Sum(45)_{1...12} =

1659.73 (45)

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

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(46)

Water storage loss:

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

0 (47)

Temperature factor from Table 2b

0 (48)

Energy lost from water storage, kWh/year

(47) x (48) =

0 (49)

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

Cylinder volume (litres) including any solar storage within same

0 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

0 (51)

Volume factor from Table 2a

0 (52)

Temperature factor from Table 2b

0 (53)

Energy lost from water storage, kWh/year

((50) x (51) x (52) x (53) =

0 (54)

Fabric Efficiency WorkSheet: New dwelling design stage

Enter (49) or (54) in (55)

0

(55)

Water storage loss calculated for each month

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

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

(56)

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

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

(57)

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

(59)

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

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

(61)

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

(62)m=	146.27	127.93	132.01	115.09	110.43	95.29	88.3	101.33	102.54	119.5	130.44	141.65
--------	--------	--------	--------	--------	--------	-------	------	--------	--------	-------	--------	--------

(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
--------	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=	146.27	127.93	132.01	115.09	110.43	95.29	88.3	101.33	102.54	119.5	130.44	141.65
--------	--------	--------	--------	--------	--------	-------	------	--------	--------	-------	--------	--------

Output from water heater (annual) 1. 12

1410.77

(64)

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

(65)m=	36.57	31.98	33	28.77	27.61	23.82	22.08	25.33	25.63	29.87	32.61	35.41
--------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------

(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55

(66)

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

(67)m=	39.41	35.01	28.47	21.55	16.11	13.6	14.7	19.1	25.64	32.56	38	40.51
--------	-------	-------	-------	-------	-------	------	------	------	-------	-------	----	-------

(67)

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

(68)m=	362.99	366.76	357.27	337.06	311.55	287.58	271.56	267.79	277.29	297.49	323	346.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------

(68)

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

(69)m=	37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=	49.15	47.59	44.36	39.96	37.11	33.09	29.67	34.05	35.6	40.15	45.29	47.6
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

(72)

Total internal gains =

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

(73)m=	519.42	517.22	497.96	466.44	432.63	402.13	383.79	388.81	406.39	438.07	474.16	502.95
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains:

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

Fabric Efficiency WorkSheet: New dwelling design stage

Orientation:	Access Factor		Area		Flux		g_		FF		Gains
	Table 6d		m²		Table 6a		Table 6b		Table 6c		(W)
East	0.9x	1	x	1.26	x	19.87	x	0.63	x	0.7	= 7.65 (76)
East	0.9x	1	x	1.26	x	38.52	x	0.63	x	0.7	= 14.83 (76)
East	0.9x	1	x	1.26	x	61.57	x	0.63	x	0.7	= 23.71 (76)
East	0.9x	1	x	1.26	x	91.41	x	0.63	x	0.7	= 35.2 (76)
East	0.9x	1	x	1.26	x	111.22	x	0.63	x	0.7	= 42.83 (76)
East	0.9x	1	x	1.26	x	116.05	x	0.63	x	0.7	= 44.69 (76)
East	0.9x	1	x	1.26	x	112.64	x	0.63	x	0.7	= 43.38 (76)
East	0.9x	1	x	1.26	x	98.03	x	0.63	x	0.7	= 37.75 (76)
East	0.9x	1	x	1.26	x	73.6	x	0.63	x	0.7	= 28.34 (76)
East	0.9x	1	x	1.26	x	46.91	x	0.63	x	0.7	= 18.06 (76)
East	0.9x	1	x	1.26	x	24.71	x	0.63	x	0.7	= 9.51 (76)
East	0.9x	1	x	1.26	x	16.39	x	0.63	x	0.7	= 6.31 (76)
South	0.9x	0.77	x	6.69	x	47.32	x	0.63	x	0.7	= 96.75 (78)
South	0.9x	0.77	x	5.57	x	47.32	x	0.63	x	0.7	= 80.56 (78)
South	0.9x	0.77	x	6.69	x	77.18	x	0.63	x	0.7	= 157.81 (78)
South	0.9x	0.77	x	5.57	x	77.18	x	0.63	x	0.7	= 131.39 (78)
South	0.9x	0.77	x	6.69	x	94.25	x	0.63	x	0.7	= 192.69 (78)
South	0.9x	0.77	x	5.57	x	94.25	x	0.63	x	0.7	= 160.43 (78)
South	0.9x	0.77	x	6.69	x	105.11	x	0.63	x	0.7	= 214.91 (78)
South	0.9x	0.77	x	5.57	x	105.11	x	0.63	x	0.7	= 178.93 (78)
South	0.9x	0.77	x	6.69	x	108.55	x	0.63	x	0.7	= 221.94 (78)
South	0.9x	0.77	x	5.57	x	108.55	x	0.63	x	0.7	= 184.78 (78)
South	0.9x	0.77	x	6.69	x	108.9	x	0.63	x	0.7	= 222.65 (78)
South	0.9x	0.77	x	5.57	x	108.9	x	0.63	x	0.7	= 185.37 (78)
South	0.9x	0.77	x	6.69	x	107.14	x	0.63	x	0.7	= 219.05 (78)
South	0.9x	0.77	x	5.57	x	107.14	x	0.63	x	0.7	= 182.38 (78)
South	0.9x	0.77	x	6.69	x	103.88	x	0.63	x	0.7	= 212.39 (78)
South	0.9x	0.77	x	5.57	x	103.88	x	0.63	x	0.7	= 176.84 (78)
South	0.9x	0.77	x	6.69	x	99.99	x	0.63	x	0.7	= 204.44 (78)
South	0.9x	0.77	x	5.57	x	99.99	x	0.63	x	0.7	= 170.21 (78)
South	0.9x	0.77	x	6.69	x	85.29	x	0.63	x	0.7	= 174.38 (78)
South	0.9x	0.77	x	5.57	x	85.29	x	0.63	x	0.7	= 145.19 (78)
South	0.9x	0.77	x	6.69	x	56.07	x	0.63	x	0.7	= 114.64 (78)
South	0.9x	0.77	x	5.57	x	56.07	x	0.63	x	0.7	= 95.44 (78)
South	0.9x	0.77	x	6.69	x	40.89	x	0.63	x	0.7	= 83.6 (78)
South	0.9x	0.77	x	5.57	x	40.89	x	0.63	x	0.7	= 69.61 (78)
West	0.9x	0.77	x	1.08	x	19.87	x	0.63	x	0.7	= 6.56 (80)
West	0.9x	0.77	x	1.08	x	38.52	x	0.63	x	0.7	= 12.71 (80)
West	0.9x	0.77	x	1.08	x	61.57	x	0.63	x	0.7	= 20.32 (80)

Fabric Efficiency WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.08	x	91.41	x	0.63	x	0.7	=	30.17	(80)
West	0.9x	0.77	x	1.08	x	111.22	x	0.63	x	0.7	=	36.71	(80)
West	0.9x	0.77	x	1.08	x	116.05	x	0.63	x	0.7	=	38.3	(80)
West	0.9x	0.77	x	1.08	x	112.64	x	0.63	x	0.7	=	37.18	(80)
West	0.9x	0.77	x	1.08	x	98.03	x	0.63	x	0.7	=	32.36	(80)
West	0.9x	0.77	x	1.08	x	73.6	x	0.63	x	0.7	=	24.29	(80)
West	0.9x	0.77	x	1.08	x	46.91	x	0.63	x	0.7	=	15.48	(80)
West	0.9x	0.77	x	1.08	x	24.71	x	0.63	x	0.7	=	8.15	(80)
West	0.9x	0.77	x	1.08	x	16.39	x	0.63	x	0.7	=	5.41	(80)

Solar gains in watts, calculated for each month

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

(83)m=	191.52	316.74	397.15	459.21	486.25	491.01	481.98	459.34	427.28	353.12	227.75	164.93	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	710.94	833.96	895.11	925.65	918.89	893.14	865.77	848.15	833.68	791.19	701.91	667.88	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	1	0.99	0.96	0.86	0.87	0.98	1	1	1	(86)

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

(87)m=	19.47	19.6	19.83	20.07	20.4	20.71	20.91	20.9	20.65	20.24	19.77	19.51	(87)
--------	-------	------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	------

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

(88)m=	19.9	19.91	19.91	19.92	19.92	19.93	19.93	19.93	19.92	19.92	19.91	19.91	(88)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	1	1	0.98	0.93	0.73	0.74	0.95	0.99	1	1	(89)
--------	---	---	---	---	------	------	------	------	------	------	---	---	------

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

(90)m=	18.5	18.63	18.86	19.11	19.45	19.74	19.9	19.9	19.68	19.28	18.8	18.54	(90)
--------	------	-------	-------	-------	-------	-------	------	------	-------	-------	------	-------	------

fLA = Living area ÷ (4) =

0.2

(91)

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

(92)m=	18.7	18.82	19.06	19.3	19.64	19.93	20.1	20.1	19.88	19.47	19	18.73	(92)
--------	------	-------	-------	------	-------	-------	------	------	-------	-------	----	-------	------

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

(93)m=	18.7	18.82	19.06	19.3	19.64	19.93	20.1	20.1	19.88	19.47	19	18.73	(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	1	1	0.99	0.98	0.93	0.75	0.76	0.95	0.99	1	1	(94)
--------	---	---	---	------	------	------	------	------	------	------	---	---	------

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

(95)m=	710.59	833.02	892.78	920.44	902.29	830.98	652.04	646.91	794.47	785.82	701.22	667.6	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
--------	-----	---	-----	-----	------	------	------	------	------	------	---	-----	------

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

(97)m=	3326.12	3222.09	2856.71	2447.73	1822.47	1220.83	731.03	730.47	1281.7	2002.13	2782.27	3224.07	(97)
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Fabric Efficiency WorkSheet: New dwelling design stage

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

(98)m=	1945.95	1605.45	1461.17	1099.64	684.61	0	0	0	0	904.93	1498.36	1902.01
--------	---------	---------	---------	---------	--------	---	---	---	---	--------	---------	---------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 11102.13 (98)

Space heating requirement in kWh/m²/year

57.94 (99)

8c. Space cooling requirement

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

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

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

(100)m=	0	0	0	0	0	2220.81	1735.61	1758.45	0	0	0	0
---------	---	---	---	---	---	---------	---------	---------	---	---	---	---

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.53	0.63	0.62	0	0	0	0
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Useful loss, hmLm (Watts) = (100)m × (101)m

(102)m=	0	0	0	0	0	1176.52	1098.73	1095.61	0	0	0	0
---------	---	---	---	---	---	---------	---------	---------	---	---	---	---

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

(103)m=	0	0	0	0	0	1205.34	1157.44	1150.12	0	0	0	0
---------	---	---	---	---	---	---------	---------	---------	---	---	---	---

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

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

(104)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

Total = Sum(104) = 0 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

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

Total = Sum(104) = 0 (106)

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

(107)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

Total = Sum(107) = 0 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 0 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 57.94 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2009

Software Version:

Version: 1.5.0.81

Property Address: Pen Y Gaer Revised

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Ave Height(m)		Volume(m ³)
Ground floor	95.8 (1a)	x	2.3 (2a)	=	220.34 (3a)
First floor	95.8 (1b)	x	2.3 (2b)	=	220.34 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	191.600006103516 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	440.68 (5)

2. Ventilation rate:

	main heating	Secondary heating	other	total		m ³ per hour
Number of chimneys	0	+	0	=	0 x 40 =	0 (6a)
Number of open flues	0	+	0	=	0 x 20 =	0 (6b)
Number of intermittent fans				3	x 10 =	30 (7a)
Number of passive vents				0	x 10 =	0 (7b)
Number of flueless gas fires				0	x 40 =	0 (7c)
Air changes per hour						
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30	÷ (5) =	0.07 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)						
Number of storeys in the dwelling (ns)						0 (9)
Additional infiltration					[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction						0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35						
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0						0 (12)
If no draught lobby, enter 0.05, else enter 0						0 (13)
Percentage of windows and doors draught stripped						0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area						5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)						0.32 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used						
Number of sides on which sheltered						2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =		0.27 (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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1
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DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27
---------	------	------	------	------	------	------	------	------	------	------	-----	------

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

	0.36	0.34	0.34	0.3	0.28	0.26	0.25	0.25	0.28	0.3	0.32	0.34
--	------	------	------	-----	------	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 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= 0.57 0.56 0.56 0.55 0.54 0.53 0.53 0.53 0.54 0.55 0.55 0.56 (24d)

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

(25)m= 0.57 0.56 0.56 0.55 0.54 0.53 0.53 0.53 0.54 0.55 0.55 0.56 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors Type 1			2.1	x 2	= 4.2		(26)
Doors Type 2			2.1	x 2	= 4.2		(26)
Doors Type 3			2.1	x 2	= 4.2		(26)
Windows Type 1			6.69	x1/[1/(1.6)+ 0.04] =	10.06		(27)
Windows Type 2			5.57	x1/[1/(1.6)+ 0.04] =	8.38		(27)
Windows Type 3			1.08	x1/[1/(1.6)+ 0.04] =	1.62		(27)
Windows Type 4			1.26	x1/[1/(1.6)+ 0.04] =	1.89		(27)
Floor			95.8	x 0.19	= 18.2		(28)
Walls Type1	283.45	20.9	262.55	x 0.24	= 63.01		(29)
Walls Type2	35.88	0	35.88	x 0.24	= 8.61		(29)
Roof Type1	61.54	0	61.54	x 0.2	= 12.31		(30)
Roof Type2	35.55	0	35.55	x 0.09	= 3.2		(30)
Roof Type3	15	0	15	x 0.09	= 1.35		(30)
Total area of elements, m²			527.220016479492				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 141.24 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 51252.2321813107 (34)

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

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

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can be used instead of a detailed calculation.

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

9.2 (36)

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

Total fabric heat loss

(33) + (36) =

150.44 (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=	82.4	81.35	81.35	79.44	78.3	77.76	77.26	77.26	78.57	79.44	80.37	81.35

(38)

Heat transfer coefficient, W/K

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

(39)m=	232.84	231.79	231.79	229.88	228.73	228.2	227.7	227.7	229.01	229.88	230.8	231.79
--------	--------	--------	--------	--------	--------	-------	-------	-------	--------	--------	-------	--------

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

230.01 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.22	1.21	1.21	1.2	1.19	1.19	1.19	1.19	1.2	1.2	1.2	1.21
--------	------	------	------	-----	------	------	------	------	-----	-----	-----	------

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

1.2 (40)

Number of days in month (Table 1a)

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

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

if TFA ≤ 13.9, N = 1

2.99 (42)

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

105.24 (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=	115.76	111.55	107.34	103.13	98.92	94.71	94.71	98.92	103.13	107.34	111.55	115.76
--------	--------	--------	--------	--------	-------	-------	-------	-------	--------	--------	--------	--------

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

1262.83 (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=	172.08	150.5	155.3	135.4	129.92	112.11	103.88	119.21	120.63	140.59	153.46	166.65
--------	--------	-------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------

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

1659.73 (45)

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

(46)m=	25.81	22.58	23.3	20.31	19.49	16.82	15.58	17.88	18.09	21.09	23.02	25
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	----

(46)

Water storage loss:

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

0 (47)

Temperature factor from Table 2b

0 (48)

Energy lost from water storage, kWh/year

(47) x (48) =

0 (49)

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

Cylinder volume (litres) including any solar storage within same

210 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

0.01 (51)

Volume factor from Table 2a

0.83 (52)

Temperature factor from Table 2b

0.54 (53)

Energy lost from water storage, kWh/year

((50) x (51) x (52) x (53) =

1.09 (54)

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Enter (49) or (54) in (55)

1.09

(55)

Water storage loss calculated for each month

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

(56)m=

33.69	30.43	33.69	32.6	33.69	32.6	33.69	33.69	32.6	33.69	32.6	33.69
-------	-------	-------	------	-------	------	-------	-------	------	-------	------	-------

(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=

33.69	30.43	33.69	32.6	33.69	32.6	33.69	33.69	32.6	33.69	32.6	33.69
-------	-------	-------	------	-------	------	-------	-------	------	-------	------	-------

(57)

Primary circuit loss (annual) from Table 3

360

(58)

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

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

(59)m=

30.58	27.62	30.58	29.59	30.58	29.59	30.58	30.58	29.59	30.58	29.59	30.58
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(59)

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

(61)m=

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

(61)

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

(62)m=

236.34	208.54	219.57	197.59	194.18	174.3	168.15	183.47	182.82	204.85	215.65	230.91
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

(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=

236.34	208.54	219.57	197.59	194.18	174.3	168.15	183.47	182.82	204.85	215.65	230.91
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) 1, 12

2416.36

(64)

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

(65)m=

108.63	96.48	103.05	94.77	94.61	87.03	85.95	91.05	89.86	98.15	100.78	106.82
--------	-------	--------	-------	-------	-------	-------	-------	-------	-------	--------	--------

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55

(66)

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

(67)m=

39.41	35.01	28.47	21.55	16.11	13.6	14.7	19.1	25.64	32.56	38	40.51
-------	-------	-------	-------	-------	------	------	------	-------	-------	----	-------

(67)

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

(68)m=

362.99	366.76	357.27	337.06	311.55	287.58	271.56	267.79	277.29	297.49	323	346.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------

(68)

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

(69)m=

37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

20	20	20	20	20	20	20	20	20	20	20	20
----	----	----	----	----	----	----	----	----	----	----	----

(70)

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

(71)m=

-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

146	143.57	138.51	131.63	127.16	120.87	115.53	122.37	124.81	131.93	139.97	143.58
-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(72)

Total internal gains =

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

(73)m=

636.27	633.19	612.1	578.1	542.69	509.91	489.65	497.14	515.6	549.84	588.83	618.92
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(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d			Area m ²	Flux Table 6a			g_ Table 6b	FF Table 6c			Gains (W)	
East	0.9x	1	x	1.26	x	19.87	x	0.63	x	0.7	=	7.65	(76)
East	0.9x	1	x	1.26	x	38.52	x	0.63	x	0.7	=	14.83	(76)
East	0.9x	1	x	1.26	x	61.57	x	0.63	x	0.7	=	23.71	(76)
East	0.9x	1	x	1.26	x	91.41	x	0.63	x	0.7	=	35.2	(76)
East	0.9x	1	x	1.26	x	111.22	x	0.63	x	0.7	=	42.83	(76)
East	0.9x	1	x	1.26	x	116.05	x	0.63	x	0.7	=	44.69	(76)
East	0.9x	1	x	1.26	x	112.64	x	0.63	x	0.7	=	43.38	(76)
East	0.9x	1	x	1.26	x	98.03	x	0.63	x	0.7	=	37.75	(76)
East	0.9x	1	x	1.26	x	73.6	x	0.63	x	0.7	=	28.34	(76)
East	0.9x	1	x	1.26	x	46.91	x	0.63	x	0.7	=	18.06	(76)
East	0.9x	1	x	1.26	x	24.71	x	0.63	x	0.7	=	9.51	(76)
East	0.9x	1	x	1.26	x	16.39	x	0.63	x	0.7	=	6.31	(76)
South	0.9x	0.77	x	6.69	x	47.32	x	0.63	x	0.7	=	96.75	(78)
South	0.9x	0.77	x	5.57	x	47.32	x	0.63	x	0.7	=	80.56	(78)
South	0.9x	0.77	x	6.69	x	77.18	x	0.63	x	0.7	=	157.81	(78)
South	0.9x	0.77	x	5.57	x	77.18	x	0.63	x	0.7	=	131.39	(78)
South	0.9x	0.77	x	6.69	x	94.25	x	0.63	x	0.7	=	192.69	(78)
South	0.9x	0.77	x	5.57	x	94.25	x	0.63	x	0.7	=	160.43	(78)
South	0.9x	0.77	x	6.69	x	105.11	x	0.63	x	0.7	=	214.91	(78)
South	0.9x	0.77	x	5.57	x	105.11	x	0.63	x	0.7	=	178.93	(78)
South	0.9x	0.77	x	6.69	x	108.55	x	0.63	x	0.7	=	221.94	(78)
South	0.9x	0.77	x	5.57	x	108.55	x	0.63	x	0.7	=	184.78	(78)
South	0.9x	0.77	x	6.69	x	108.9	x	0.63	x	0.7	=	222.65	(78)
South	0.9x	0.77	x	5.57	x	108.9	x	0.63	x	0.7	=	185.37	(78)
South	0.9x	0.77	x	6.69	x	107.14	x	0.63	x	0.7	=	219.05	(78)
South	0.9x	0.77	x	5.57	x	107.14	x	0.63	x	0.7	=	182.38	(78)
South	0.9x	0.77	x	6.69	x	103.88	x	0.63	x	0.7	=	212.39	(78)
South	0.9x	0.77	x	5.57	x	103.88	x	0.63	x	0.7	=	176.84	(78)
South	0.9x	0.77	x	6.69	x	99.99	x	0.63	x	0.7	=	204.44	(78)
South	0.9x	0.77	x	5.57	x	99.99	x	0.63	x	0.7	=	170.21	(78)
South	0.9x	0.77	x	6.69	x	85.29	x	0.63	x	0.7	=	174.38	(78)
South	0.9x	0.77	x	5.57	x	85.29	x	0.63	x	0.7	=	145.19	(78)
South	0.9x	0.77	x	6.69	x	56.07	x	0.63	x	0.7	=	114.64	(78)
South	0.9x	0.77	x	5.57	x	56.07	x	0.63	x	0.7	=	95.44	(78)
South	0.9x	0.77	x	6.69	x	40.89	x	0.63	x	0.7	=	83.6	(78)
South	0.9x	0.77	x	5.57	x	40.89	x	0.63	x	0.7	=	69.61	(78)
West	0.9x	0.77	x	1.08	x	19.87	x	0.63	x	0.7	=	6.56	(80)
West	0.9x	0.77	x	1.08	x	38.52	x	0.63	x	0.7	=	12.71	(80)
West	0.9x	0.77	x	1.08	x	61.57	x	0.63	x	0.7	=	20.32	(80)

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West	0.9x	0.77	x	1.08	x	91.41	x	0.63	x	0.7	=	30.17	(80)
West	0.9x	0.77	x	1.08	x	111.22	x	0.63	x	0.7	=	36.71	(80)
West	0.9x	0.77	x	1.08	x	116.05	x	0.63	x	0.7	=	38.3	(80)
West	0.9x	0.77	x	1.08	x	112.64	x	0.63	x	0.7	=	37.18	(80)
West	0.9x	0.77	x	1.08	x	98.03	x	0.63	x	0.7	=	32.36	(80)
West	0.9x	0.77	x	1.08	x	73.6	x	0.63	x	0.7	=	24.29	(80)
West	0.9x	0.77	x	1.08	x	46.91	x	0.63	x	0.7	=	15.48	(80)
West	0.9x	0.77	x	1.08	x	24.71	x	0.63	x	0.7	=	8.15	(80)
West	0.9x	0.77	x	1.08	x	16.39	x	0.63	x	0.7	=	5.41	(80)

Solar gains in watts, calculated for each month

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

(83)m=	191.52	316.74	397.15	459.21	486.25	491.01	481.98	459.34	427.28	353.12	227.75	164.93	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	827.79	949.93	1009.25	1037.32	1028.94	1000.93	971.63	956.47	942.88	902.96	816.58	783.85	(84)
--------	--------	--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	1	0.98	0.94	0.81	0.82	0.96	0.99	1	1	(86)

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

(87)m=	19.54	19.66	19.89	20.13	20.46	20.75	20.93	20.93	20.69	20.3	19.83	19.57	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(88)m=	19.91	19.91	19.91	19.92	19.93	19.93	19.93	19.93	19.93	19.92	19.92	19.91	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	1	0.99	0.98	0.9	0.67	0.67	0.93	0.99	1	1	(89)
--------	---	---	---	------	------	-----	------	------	------	------	---	---	------

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

(90)m=	17.95	18.13	18.47	18.82	19.3	19.7	19.9	19.9	19.63	19.07	18.38	18	(90)
--------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	----	------

fLA = Living area ÷ (4) =

0.2

(91)

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

(92)m=	18.27	18.44	18.76	19.08	19.53	19.91	20.11	20.11	19.85	19.31	18.67	18.32	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.12	18.29	18.61	18.93	19.38	19.76	19.96	19.96	19.7	19.16	18.52	18.17	(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	1	0.99	0.99	0.97	0.89	0.67	0.68	0.92	0.99	1	1	(94)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(95)m=	826.84	947.68	1004.07	1026.37	996.23	891.05	651.39	648.68	867.78	890.64	814.72	783.06	(95)
--------	--------	--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	3171.5	3080.67	2736.6	2352.35	1757.73	1178.65	696.3	695.86	1235.96	1922.79	2658.96	3074.82	(97)
--------	--------	---------	--------	---------	---------	---------	-------	--------	---------	---------	---------	---------	------

DER WorkSheet: New dwelling design stage

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

(98)m=	1744.43	1433.37	1289	954.71	566.55	0	0	0	0	767.92	1327.85	1705.07	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													9788.91 (98)

Space heating requirement in kWh/m²/year

51.09 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0.1 (201)

Fraction of space heat from main system(s)

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

0.9 (202)

Fraction of total heating from main system 1

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

0.9 (204)

Efficiency of main space heating system 1

95.9 (206)

Efficiency of secondary/supplementary heating system, %

65 (208)

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

1744.43	1433.37	1289	954.71	566.55	0	0	0	0	767.92	1327.85	1705.07
---------	---------	------	--------	--------	---	---	---	---	--------	---------	---------

$$(211)m = \{[(98)m \times (204)] + (210)m\} \times 100 \div (206)$$

(211)

1637.11	1345.19	1209.7	895.97	531.7	0	0	0	0	720.67	1246.16	1600.17
---------	---------	--------	--------	-------	---	---	---	---	--------	---------	---------

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

9186.67 (211)

Space heating fuel (secondary), kWh/month

$$= \{[(98)m \times (201)] + (214)m\} \times 100 \div (208)$$

(215)m=	268.37	220.52	198.31	146.88	87.16	0	0	0	0	118.14	204.28	262.32
---------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

1505.99 (215)

Water heating

Output from water heater (calculated above)

236.34	208.54	219.57	197.59	194.18	174.3	168.15	183.47	182.82	204.85	215.65	230.91
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

82.7 (216)

(217)m=	92.68	92.58	92.32	91.97	90.86	82.7	82.7	82.7	82.7	91.44	92.4	92.68
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	------	-------

(217)

Fuel for water heating, kWh/month

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

(219)m=	254.99	225.26	237.83	214.84	213.72	210.76	203.32	221.85	221.07	224.02	233.38	249.13
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2710.19 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

9186.67

Space heating fuel used, secondary

1505.99

Water heating fuel used

2710.19

Electricity for pumps, fans and electric keep-hot

central heating pump:

130 (230c)

oil boiler pump

100 (230d)

Total electricity for the above, kWh/year

$$\text{sum of (230a)...(230g)} =$$

230 (231)

Electricity for lighting

696.04 (232)

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

DER WorkSheet: New dwelling design stage

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.274 =	2517.15 (261)
Space heating (secondary)	(215) x	0.008 =	12.05 (263)
Water heating	(219) x	0.274 =	742.59 (264)
Space and water heating	(261) + (262) + (263) + (264) =		3271.79 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517 =	118.91 (267)
Electricity for lighting	(232) x	0.517 =	359.85 (268)
Total CO2, kg/year		sum of (265)...(271) =	3750.55 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	19.57 (273)
EI rating (section 14)			79 (274)

DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2009

Software Version:

Version: 1.5.0.81

Property Address: Pen Y Gaer Revised

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Ave Height(m)		Volume(m ³)
Ground floor	95.8 (1a)	x	2.3 (2a)	=	220.34 (3a)
First floor	95.8 (1b)	x	2.3 (2b)	=	220.34 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	191.6 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	440.68 (5)

2. Ventilation rate:

	main heating	Secondary heating	other	total		m ³ per hour
Number of chimneys	0	+	0	=	0	x 40 = 0 (6a)
Number of open flues	0	+	0	=	0	x 20 = 0 (6b)
Number of intermittent fans				3	x 10 =	30 (7a)
Number of passive vents				0	x 10 =	0 (7b)
Number of flueless gas fires				0	x 40 =	0 (7c)
						Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30	÷ (5) =	0.07 (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						10 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)						0.57 (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 on which sheltered						2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =		0.48 (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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1
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TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27
---------	------	------	------	------	------	------	------	------	------	------	-----	------

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

	0.65	0.62	0.62	0.54	0.49	0.47	0.45	0.45	0.51	0.54	0.58	0.62
--	------	------	------	------	------	------	------	------	------	------	------	------

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

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

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

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 × 0.5]

(24d)m=	0.71	0.69	0.69	0.65	0.62	0.61	0.6	0.6	0.63	0.65	0.67	0.69
---------	------	------	------	------	------	------	-----	-----	------	------	------	------

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

(25)m=	0.71	0.69	0.69	0.65	0.62	0.61	0.6	0.6	0.63	0.65	0.67	0.69
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.85	2	3.7		(26)
Windows			46.05	1/[1/(2) + 0.04]	85.28		(27)
Floor			95.8	0.25	23.95		(28)
Walls	319.33	47.9	271.43	0.35	95		(29)
Roof Type1	61.54	0	61.54	0.16	9.85		(30)
Roof Type2	35.55	0	35.55	0.16	5.69		(30)
Roof Type3	15	0	15	0.16	2.4		(30)
Total area of elements, m²			527.22				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 225.86 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 11546.8103 (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 57.99 (36)

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

Total fabric heat loss (33) + (36) = 283.86 (37)

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

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

103.61	100.27	100.27	94.17	90.52	88.83	87.22	87.22	91.4	94.17	97.13	100.27
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 (38)

Heat transfer coefficient, W/K

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

(39)m=

387.47	384.13	384.13	378.03	374.38	372.69	371.07	371.07	375.26	378.03	380.98	384.13
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

378.45 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

2.02	2	2	1.97	1.95	1.95	1.94	1.94	1.96	1.97	1.99	2
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Average = Sum(40)_{1...12} /12=

1.98 (40)

Number of days in month (Table 1a)

(41)m=

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

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

if TFA ≤ 13.9, N = 1

2.99 (42)

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

110.77 (43)

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

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

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

(44)m=

121.85	117.42	112.99	108.56	104.13	99.7	99.7	104.13	108.56	112.99	117.42	121.85
--------	--------	--------	--------	--------	------	------	--------	--------	--------	--------	--------

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

1329.29 (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=

181.14	158.42	163.48	142.52	136.75	118.01	109.35	125.48	126.98	147.99	161.54	175.42
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Total = Sum(45)_{1...12} =

1747.08 (45)

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

(46)m=

27.17	23.76	24.52	21.38	20.51	17.7	16.4	18.82	19.05	22.2	24.23	26.31
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 (46)

Water storage loss:

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

0 (47)

Temperature factor from Table 2b

0 (48)

Energy lost from water storage, kWh/year

(47) x (48) =

0 (49)

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

Cylinder volume (litres) including any solar storage within same

150 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

0.02 (51)

Volume factor from Table 2a

0.93 (52)

Temperature factor from Table 2b

0.54 (53)

Energy lost from water storage, kWh/year

((50) x (51) x (52) x (53) =

1.44 (54)

Enter (49) or (54) in (55)

1.44 (55)

Water storage loss calculated for each month

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

(56)m=

44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53
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 (57)

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Primary circuit loss (annual) from Table 3

610

(58)

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

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

(59)m=

51.81	46.79	51.81	50.14	51.81	50.14	51.81	51.81	50.14	51.81	50.14	51.81
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(59)

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

(61)m=

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

(61)

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

(62)m=

277.47	245.44	259.81	235.75	233.09	211.24	205.69	221.82	220.21	244.32	254.77	271.76
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(62)

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

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

(63)m=

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

(63)

Output from water heater

(64)m=

277.47	245.44	259.81	235.75	233.09	211.24	205.69	221.82	220.21	244.32	254.77	271.76
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2881.37

(64)

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

(65)m=

137.3	122.29	131.43	121.97	122.54	113.82	113.43	118.79	116.8	126.27	128.29	135.4
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(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55	149.55

(66)

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

(67)m=

55.01	48.86	39.74	30.08	22.49	18.99	20.51	26.67	35.79	45.44	53.04	56.54
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(67)

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

(68)m=

362.99	366.76	357.27	337.06	311.55	287.58	271.56	267.79	277.29	297.49	323	346.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------

(68)

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

(69)m=

37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95	37.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

10	10	10	10	10	10	10	10	10	10	10	10
----	----	----	----	----	----	----	----	----	----	----	----

(70)

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

(71)m=

-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64	-119.64
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

184.54	181.97	176.65	169.41	164.7	158.08	152.46	159.67	162.23	169.72	178.19	181.98
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(72)

Total internal gains =

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

(73)m=

680.41	675.46	651.51	614.41	576.61	542.51	522.4	531.99	553.17	590.52	632.09	663.37
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(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
East	0.9x	1	x	46.05	x	19.87	x	0.72	x	0.7	=	319.63	(76)
East	0.9x	1	x	46.05	x	38.52	x	0.72	x	0.7	=	619.53	(76)

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East	0.9x	1	x	46.05	x	61.57	x	0.72	x	0.7	=	990.21	(76)
East	0.9x	1	x	46.05	x	91.41	x	0.72	x	0.7	=	1470.23	(76)
East	0.9x	1	x	46.05	x	111.22	x	0.72	x	0.7	=	1788.85	(76)
East	0.9x	1	x	46.05	x	116.05	x	0.72	x	0.7	=	1866.58	(76)
East	0.9x	1	x	46.05	x	112.64	x	0.72	x	0.7	=	1811.73	(76)
East	0.9x	1	x	46.05	x	98.03	x	0.72	x	0.7	=	1576.79	(76)
East	0.9x	1	x	46.05	x	73.6	x	0.72	x	0.7	=	1183.84	(76)
East	0.9x	1	x	46.05	x	46.91	x	0.72	x	0.7	=	754.48	(76)
East	0.9x	1	x	46.05	x	24.71	x	0.72	x	0.7	=	397.38	(76)
East	0.9x	1	x	46.05	x	16.39	x	0.72	x	0.7	=	263.66	(76)

Solar gains in watts, calculated for each month

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

(83)m=	319.63	619.53	990.21	1470.23	1788.85	1866.58	1811.73	1576.79	1183.84	754.48	397.38	263.66	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1000.04	1294.99	1641.73	2084.65	2365.46	2409.09	2334.12	2108.78	1737.01	1345	1029.47	927.03	(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	0.96	0.89	0.77	0.59	0.63	0.89	0.98	1	1	(86)

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

(87)m=	18.72	18.94	19.37	19.87	20.41	20.77	20.94	20.92	20.59	19.92	19.17	18.77	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.33	19.34	19.34	19.36	19.37	19.38	19.38	19.38	19.37	19.36	19.35	19.34	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.94	0.84	0.64	0.38	0.42	0.8	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=	17.32	17.55	17.98	18.48	18.99	19.28	19.37	19.37	19.15	18.53	17.78	17.38	(90)
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fLA = Living area ÷ (4) =

0.2 (91)

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

(92)m=	17.6	17.83	18.26	18.76	19.28	19.58	19.69	19.68	19.44	18.81	18.06	17.66	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	17.6	17.83	18.26	18.76	19.28	19.58	19.69	19.68	19.44	18.81	18.06	17.66	(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=	1	0.99	0.98	0.93	0.84	0.66	0.43	0.47	0.81	0.96	0.99	1	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	996.19	1283.49	1601.78	1948.68	1976.67	1596.69	996.6	983.07	1406.05	1294.09	1022.32	923.99	(95)
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Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
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TER WorkSheet: New dwelling design stage

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

(97)m=

5075.59	4927.29	4401.52	3802.68	2837.11	1855.69	1034.1	1031.9	1929.02	3029	4214.3	4900.45
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 (97)

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

(98)m=

3035.07	2448.64	2083	1334.88	640.17	0	0	0	0	1290.77	2298.22	2958.49
---------	---------	------	---------	--------	---	---	---	---	---------	---------	---------

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

16089.23

 (98)

Space heating requirement in kWh/m²/year

83.97

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0.1

 (201)

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

0.9

 (202)

Fraction of total heating from main system 1 (204) = $(202) \times [1 - (203)] =$

0.9

 (204)

Efficiency of main space heating system 1

78.9

 (206)

Efficiency of secondary/supplementary heating system, %

100

 (208)

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

3035.07	2448.64	2083	1334.88	640.17	0	0	0	0	1290.77	2298.22	2958.49
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(211)m = $\{[(98)m \times (204)] + (210)m\} \times 100 \div (206)$ (211)

3462.05	2793.12	2376.05	1522.68	730.23	0	0	0	0	1472.36	2621.55	3374.7
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Total (kWh/year) = Sum(211)_{1...5,10...12} =

18352.74

 (211)

Space heating fuel (secondary), kWh/month
= $\{[(98)m \times (201)] + (214)m\} \times 100 \div (208)$

(215)m=

303.51	244.86	208.3	133.49	64.02	0	0	0	0	129.08	229.82	295.85
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Total (kWh/year) = Sum(215)_{1...5,10...12} =

1608.92

 (215)

Water heating

Output from water heater (calculated above)

277.47	245.44	259.81	235.75	233.09	211.24	205.69	221.82	220.21	244.32	254.77	271.76
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Efficiency of water heater

68.8

 (216)

(217)m=

77.85	77.76	77.51	77.04	75.7	68.8	68.8	68.8	68.8	76.94	77.65	77.84
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 (217)

Fuel for water heating, kWh/month

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

(219)m=

356.44	315.65	335.18	305.99	307.92	307.03	298.97	322.41	320.07	317.56	328.1	349.11
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Total = Sum(219a)_{1...12} =

3864.43

 (219)

Annual totals

Space heating fuel used, main system 1

18352.74

 kWh/year

Space heating fuel used, secondary

1608.92

 kWh/year

Water heating fuel used

3864.43

 kWh/year

Electricity for pumps, fans and electric keep-hot

central heating pump:

130

 (230c)

boiler with a fan-assisted flue

45

 (230e)

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

175

 (231)

Electricity for lighting

971.56

 (232)

TER WorkSheet: New dwelling design stage

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	0.194 =	3560.43 (261)
Space heating (secondary)	(215) x	0.422 =	678.97 (263)
Water heating	(219) x	0.194 =	749.7 (264)
Space and water heating	(261) + (262) + (263) + (264) =		4989.1 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.422 =	73.85 (267)
Electricity for lighting	(232) x	0.422 =	410 (268)
Total CO2, kg/year		sum of (265)...(271) =	5472.94 (272)
TER =			20.75 (273)

DRAFT

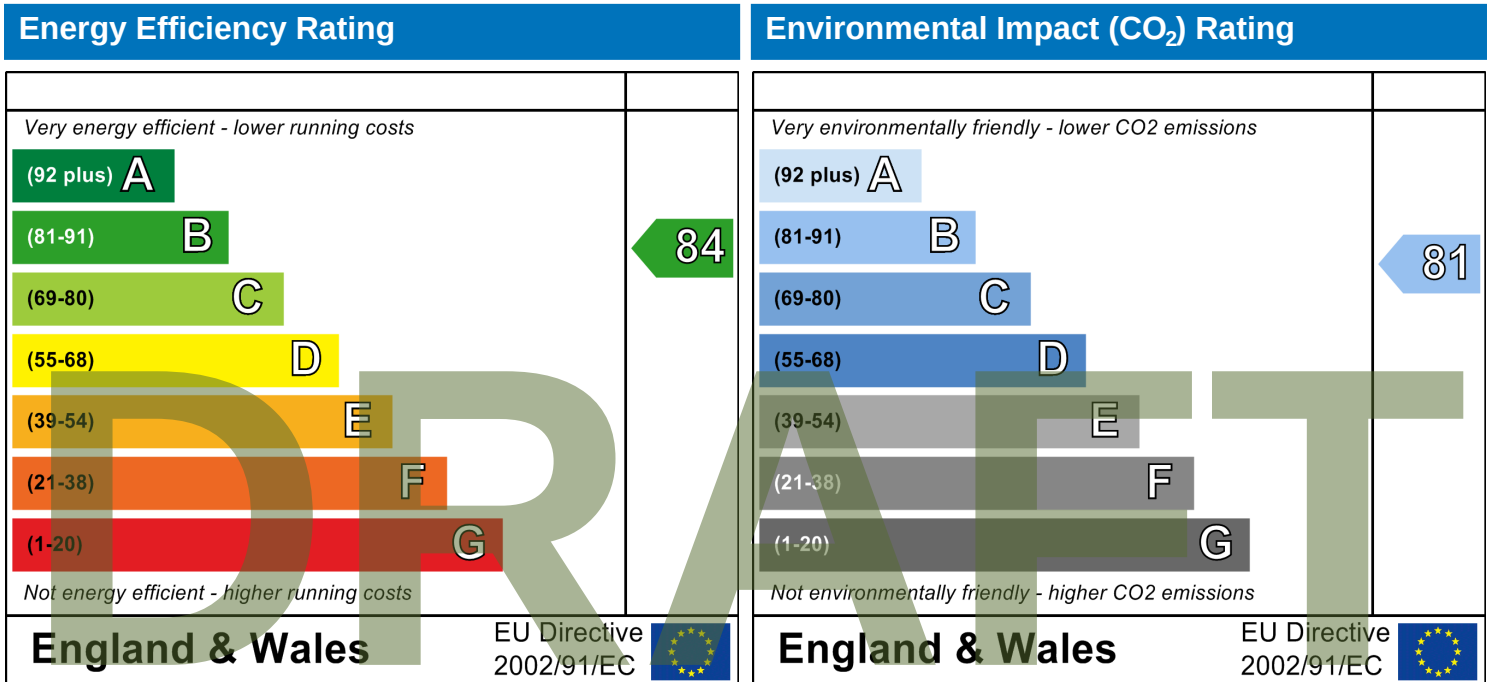
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Detached Bungalow
21 July 2014
Stroma Certification
191.6 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2009 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.