

SAP WorkSheet: New dwelling design stage

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Stroma Number:

STRO006629

Software Name: Stroma FSAP 2009

Software Version:

Version: 1.5.0.49

Address : Plot 1, 3 Marine Drive West, Bognor Regis, PO21

	Area(m ²)	Ave Height(m)	Volume(m ³)
Ground floor	51 (1a)	2.4 (2a)	122.4 (3a)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)

51 (4)

Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = 122.4 (5)

	main heating	Secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =

20 + (5) = 0.16 (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

15 (17)

If based on air permeability value, then (18) = [(17) + 20] + (8), otherwise (18) = (16)

0.91 (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

3 (19)

Shelter factor

(20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor

(21) = (18) x (20) = 0.71 (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

0.96	0.9	0.9	0.8	0.73	0.69	0.65	0.65	0.74	0.8	0.85	0.9
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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) x 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) x [1 - (23c) ÷ 100]

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

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

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

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

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

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

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.96 0.91 0.91 0.82 0.76 0.74 0.71 0.71 0.78 0.82 0.86 0.91 (24d)

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

(25)m= 0.96 0.91 0.91 0.82 0.76 0.74 0.71 0.71 0.78 0.82 0.86 0.91 (25)

~~Table 1: Fabric heat loss calculation~~

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			2.52	1.5	3.78		
Windows Type 1			1.42	1/(1/(1.5) + 0.04)	2.01		
Windows Type 2			2.73	1/(1/(1.5) + 0.04)	3.86		
Windows Type 3			8.19	1/(1/(1.5) + 0.04)	11.59		
Floor			51	0.2	10.2		
Walls Type1	47.04	16.28	30.76	0.25	7.69		
Walls Type2	3.84	0	3.84	0.27	1.02		
Total area of elements, m²			101.88				

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 42.16 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 15.28 (36)

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

Total fabric heat loss (33) + (36) = 57.45 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	38.64	36.65	36.65	33	30.83	29.82	28.86	28.86	31.35	33	34.77	36.65

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

Heat transfer coefficient, W/K												
(39)m=	96.09	94.09	94.09	90.45	88.27	87.26	86.3	86.3	88.8	90.45	92.21	94.09
Average = Sum(39) _{1, 12} /12=												
90.7												

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Heat loss parameter (HLP), W/m²K

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

(40)m=	1.88	1.84	1.84	1.77	1.73	1.71	1.69	1.69	1.74	1.77	1.81	1.84
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$$\text{Average} = \text{Sum}(40)_{1..12} / 12 =$$

1.78

(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)

Assumed occupancy, N

1.7196

(42)

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

if TFA ≤ 13.9, N = 1

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

78.9893

(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=	86.89	83.73	80.57	77.41	74.25	71.09	71.09	74.25	77.41	80.57	83.73	86.89
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$$\text{Total} = \text{Sum}(44)_{1..12} =$$

947.8713

(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=	129.16	112.96	116.57	101.63	97.51	84.15	77.98	89.48	90.55	105.52	115.19	125.09
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$$\text{Total} = \text{Sum}(45)_{1..12} =$$

1245.7821

(45)

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

(46)m=	19.37	16.94	17.49	15.24	14.63	12.62	11.7	13.42	13.58	15.83	17.28	18.76
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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

$$(47) \times (48) =$$

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

$$((50) \times (51) \times (52) \times (53) =$$

0

(54)

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	0
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(56)

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

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

(61)m=	44.28	38.54	41.06	38.17	37.84	35.06	36.23	37.84	38.17	41.06	41.29	44.28
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(61)

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

(62)m=	173.44	151.5	157.63	139.8	135.35	119.21	114.2	127.31	128.72	146.58	156.48	169.36	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
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Output from water heater

(64)m=	173.44	151.5	157.63	139.8	135.35	119.21	114.2	127.31	128.72	146.58	156.48	169.36	
Output from water heater (annual) 1...12												1719.5879	(64)

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

(65)m=	54.02	47.2	49.02	43.34	41.88	36.74	34.98	39.21	39.65	45.35	48.62	52.66	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	103.17	103.17	103.17	103.17	103.17	103.17	103.17	103.17	103.17	103.17	103.17	103.17	(66)

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

(67)m=	33.39	29.66	24.12	18.26	13.65	11.52	12.45	16.19	21.73	27.58	32.2	34.32	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	223.63	225.95	220.1	207.65	191.94	177.17	167.3	164.98	170.83	183.28	198.99	213.76	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	47.04	47.04	47.04	47.04	47.04	47.04	47.04	47.04	47.04	47.04	47.04	47.04	(69)
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Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)
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Water heating gains (Table 5)

(72)m=	72.6	70.23	65.89	60.19	56.29	51.03	47.02	52.7	55.07	60.96	67.53	70.78	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	421.05	417.27	401.54	377.53	353.31	331.15	318.2	325.3	339.05	363.25	390.15	410.29	(73)
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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 _s Table 6b	FF Table 6c	Gains (W)	
South	0.9x 0.77	x 8.19	x 47.32	x 0.63	x 0.7	= 118.45	(78)
South	0.9x 0.77	x 8.19	x 77.18	x 0.63	x 0.7	= 193.19	(78)
South	0.9x 0.77	x 8.19	x 94.25	x 0.63	x 0.7	= 235.9	(78)
South	0.9x 0.77	x 8.19	x 105.11	x 0.63	x 0.7	= 263.1	(78)
South	0.9x 0.77	x 8.19	x 108.55	x 0.63	x 0.7	= 271.7	(78)
South	0.9x 0.77	x 8.19	x 108.9	x 0.63	x 0.7	= 272.57	(78)
South	0.9x 0.77	x 8.19	x 107.14	x 0.63	x 0.7	= 268.16	(78)
South	0.9x 0.77	x 8.19	x 103.88	x 0.63	x 0.7	= 260.02	(78)

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South	0.9x	0.77	x	8.19	x	99.99	x	0.63	x	0.7	=	250.27	(78)
South	0.9x	0.77	x	8.19	x	85.29	x	0.63	x	0.7	=	213.48	(78)
South	0.9x	0.77	x	8.19	x	56.07	x	0.63	x	0.7	=	140.34	(78)
South	0.9x	0.77	x	8.19	x	40.89	x	0.63	x	0.7	=	102.35	(78)
West	0.9x	0.77	x	1.42	x	19.87	x	0.63	x	0.7	=	17.25	(80)
West	0.9x	0.77	x	2.73	x	19.87	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.42	x	38.52	x	0.63	x	0.7	=	33.43	(80)
West	0.9x	0.77	x	2.73	x	38.52	x	0.63	x	0.7	=	32.14	(80)
West	0.9x	0.77	x	1.42	x	61.57	x	0.63	x	0.7	=	53.43	(80)
West	0.9x	0.77	x	2.73	x	61.57	x	0.63	x	0.7	=	51.37	(80)
West	0.9x	0.77	x	1.42	x	91.41	x	0.63	x	0.7	=	79.34	(80)
West	0.9x	0.77	x	2.73	x	91.41	x	0.63	x	0.7	=	76.27	(80)
West	0.9x	0.77	x	1.42	x	111.22	x	0.63	x	0.7	=	96.53	(80)
West	0.9x	0.77	x	2.73	x	111.22	x	0.63	x	0.7	=	92.79	(80)
West	0.9x	0.77	x	1.42	x	116.05	x	0.63	x	0.7	=	100.73	(80)
West	0.9x	0.77	x	2.73	x	116.05	x	0.63	x	0.7	=	96.82	(80)
West	0.9x	0.77	x	1.42	x	112.64	x	0.63	x	0.7	=	97.77	(80)
West	0.9x	0.77	x	2.73	x	112.64	x	0.63	x	0.7	=	93.98	(80)
West	0.9x	0.77	x	1.42	x	98.03	x	0.63	x	0.7	=	85.09	(80)
West	0.9x	0.77	x	2.73	x	98.03	x	0.63	x	0.7	=	81.79	(80)
West	0.9x	0.77	x	1.42	x	73.6	x	0.63	x	0.7	=	63.88	(80)
West	0.9x	0.77	x	2.73	x	73.6	x	0.63	x	0.7	=	61.41	(80)
West	0.9x	0.77	x	1.42	x	46.91	x	0.63	x	0.7	=	40.71	(80)
West	0.9x	0.77	x	2.73	x	46.91	x	0.63	x	0.7	=	39.14	(80)
West	0.9x	0.77	x	1.42	x	24.71	x	0.63	x	0.7	=	21.44	(80)
West	0.9x	0.77	x	2.73	x	24.71	x	0.63	x	0.7	=	20.61	(80)
West	0.9x	0.77	x	1.42	x	16.39	x	0.63	x	0.7	=	14.23	(80)
West	0.9x	0.77	x	2.73	x	16.39	x	0.63	x	0.7	=	13.68	(80)

Solar gains in watts, calculated for each month

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

(83)m=	152.28	258.76	340.7	418.7	461.02	470.12	459.91	426.9	375.57	293.33	182.4	130.25	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	573.33	676.02	742.24	796.23	814.33	801.27	778.11	752.19	714.62	656.58	572.54	540.54	(84)
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Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.97	0.94	0.89	0.79	0.63	0.44	0.46	0.71	0.89	0.97	0.98	(86)

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

(87)m=	19.34	19.61	19.96	20.33	20.7	20.91	20.98	20.98	20.85	20.44	19.79	19.39	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.42	19.44	19.44	19.49	19.52	19.54	19.55	19.55	19.52	19.49	19.47	19.44	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.95	0.92	0.86	0.72	0.51	0.29	0.3	0.59	0.85	0.96	0.98	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18	18.28	18.61	19.01	19.35	19.5	19.55	19.55	19.45	19.11	18.48	18.07	(90)
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fLA = Living area + (4) = 0.65 (91)

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

(92)m=	18.86	19.14	19.48	19.87	20.22	20.41	20.48	20.48	20.36	19.97	19.33	18.93	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.86	19.14	19.48	19.87	20.22	20.41	20.48	20.48	20.36	19.97	19.33	18.93	(93)
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Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

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

(94)m=	0.97	0.95	0.92	0.87	0.75	0.58	0.39	0.4	0.66	0.86	0.95	0.97	(94)
--------	------	------	------	------	------	------	------	-----	------	------	------	------	------

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	556.93	643.58	682.16	688.97	614.01	468.54	302.69	301.92	473.84	567.45	546.69	526.37	(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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Heat loss rate for mean internal temperature, Lm, W = [(39)m × [(93)m – (96)m]

(97)m=	1380.25	1330.25	1193.29	1009.91	752.47	507.23	308.65	308.53	537.98	829.85	1136.7	1319.7	(97)
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Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	612.55	461.44	380.28	231.07	103.02	0	0	0	0	195.23	424.81	590.23	
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	--

Total per year (kWh/year) = Sum(98)_{1,5,9,12} = 2998.64 (98)

Space heating requirement in kWh/m²/year

58.8 (99)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

89.9 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

612.55	461.44	380.28	231.07	103.02	0	0	0	0	195.23	424.81	590.23
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

(211)m = [(98)m × (204)] + (210)m × 100 + (206) (211)

681.37	513.28	423	257.03	114.59	0	0	0	0	217.16	472.54	656.55
--------	--------	-----	--------	--------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1,5,10,12} = 3335.52 (211)

Space heating fuel (secondary), kWh/month

= [(98)m × (201)] + (214)m × 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	
---------	---	---	---	---	---	---	---	---	---	---	---	--

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

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

173.44	151.5	157.63	139.8	135.35	119.21	114.2	127.31	128.72	146.58	156.48	169.36
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Efficiency of water heater

79.8 (216)

(217)m=	87.46	87.17	86.68	85.81	83.87	79.8	79.8	79.8	79.8	85.27	86.94	87.43
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(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 + (217)m

(219)m=	198.31	173.8	181.84	162.93	161.38	149.38	143.11	159.54	161.3	171.9	179.99	193.71
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Total = Sum(219a)... =

2037.18 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3335.52

Water heating fuel used

2037.18

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

235.9

(232)

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.1	x 0.01 =	103.4012 (240)
Space heating - main system 2	(213) x	0	x 0.01 =	0 (241)
Space heating - secondary	(215) x	0	x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.1	x 0.01 =	63.15 (247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 =	20.06 (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 =	27.03 (250)
Additional standing charges (Table 12)				106 (251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost

(245)...(247) + (250)...(254) =

319.6428 (255)

Energy cost deflator (Table 12)

0.47

(256)

Energy cost factor (ECF)

[(255) x (256)] + [(4) + 45.0] =

1.5649

(257)

SAP rating (Section 12)

78.1694

(258)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.198	=	660.43 (261)

SAP WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0	=	0	(263)
Water heating	(219) x	0.198	=	403.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1063.8	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48	(267)
Electricity for lighting	(232) x	0.517	=	121.96	(268)
Total CO2, kg/year		sum of (265)...(271) =		1276.23	(272)
CO2 emissions per m²		(272) + (4) =		25.02	(273)
EI rating (section 14)				82	(274)

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.02	=	3402.23	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	2077.93	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5480.16	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	688.82	(268)
*Total Primary Energy		sum of (265)...(271) =		6679.98	(272)
Primary energy kWh/m²/year		(272) + (4) =		130.98	(273)

Predicted Energy Assessment



Plot 2
3 Marine Drive West
Bognor Regis
PO21

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

Enclosed end Ground floor Flat
08 August 2013
Ondrej Gajdos
46 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.

Energy Efficiency Rating	Environmental Impact (CO ₂) Rating
Very energy efficient - lower running costs (92-100) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not energy efficient - higher running costs 78	Very environmentally friendly - lower CO₂ emissions (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not environmentally friendly - higher CO₂ emissions 82
England & Wales EU Directive 2002/91/EC	England & Wales EU Directive 2002/91/EC

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.

SAP WorkSheet: New dwelling design stage

Assessor Name: Ondrej Gajdos

Stroma Number:

STRO006629

Software Name: Stroma FSAP 2009

Software Version:

Version: 1.5.0.49

Address : Plot 2, 3 Marine Drive West, Bognor Regis, PO21

	Area(m ²)		Ave Height(m)		Volume(m ³)
Ground floor	46 (1a)	x	2.4 (2a)	=	110.4 (3a)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)

46 (4)

Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =

110.4 (5)

	main heating	Secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =

20

+ (5) =

0.18 (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 use 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

15 (17)

If based on air permeability value, then (18) = [(17) + 20]x(8), otherwise (18) = (16)

0.93 (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

3 (19)

Shelter factor

(20) = 1 - [0.075 x (19)] =

0.78 (20)

Infiltration rate incorporating shelter factor

(21) = (18) x (20) =

0.72 (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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SAP WorkSheet: New dwelling design stage

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

0.97	0.92	0.92	0.81	0.74	0.7	0.67	0.67	0.76	0.81	0.87	0.92
------	------	------	------	------	-----	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

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

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

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

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

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

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

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.97 0.92 0.92 0.83 0.77 0.75 0.72 0.72 0.79 0.83 0.88 0.92 (24d)

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

(25)m= 0.97 0.92 0.92 0.83 0.77 0.75 0.72 0.72 0.79 0.83 0.88 0.92 (25)

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			2.52	1.5	3.78		
Windows Type 1			1.44	1/[1/(1.5) + 0.04]	2.04		
Windows Type 2			2.73	1/[1/(1.5) + 0.04]	3.86		
Windows Type 3			8.19	1/[1/(1.5) + 0.04]	11.59		
Floor			46	0.2	9.2		
Walls Type1	38.4	16.32	22.08	0.25	5.52		
Walls Type2	5.28	0	5.28	0.27	1.41		
Walls Type3	6.72	0	6.72	0.25	1.68		
Total area of elements, m²			96.4				

* 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) = 41.11 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 14.46 (36)

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

Total fabric heat loss (33) + (36) = 55.57 (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=	35.51	33.64	33.64	30.22	28.18	27.23	26.33	26.33	28.67	30.22	31.88	33.64

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

(39)m=	91.08	89.21	89.21	85.8	83.76	82.81	81.91	81.91	84.25	85.8	87.45	89.21
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Average = Sum(39)..... /12= 86.08 Page 2 of 8

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.98	1.94	1.94	1.87	1.82	1.8	1.78	1.78	1.83	1.87	1.9	1.94	
Average = Sum(40) _{1..12} / 12 =													1.87 (40)

Number of days in month (Table 1a)

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

Assumed occupancy, N

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

$$\text{if TFA} \leq 13.9, N = 1$$

1.5733 (42)

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

75.3336 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.87	79.85	76.84	73.83	70.81	67.8	67.8	70.81	73.83	76.84	79.85	82.87	
Total = Sum(44) _{1..12} =													904.0033 (44)

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

(45)m=	123.18	107.74	111.17	96.92	93	80.25	74.37	85.34	86.36	100.64	109.86	119.3	
Total = Sum(45) _{1..12} =													1188.1267 (45)

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

(46)m=	18.48	16.16	16.68	14.54	13.95	12.04	11.16	12.8	12.95	15.1	16.48	17.89	(46)
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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

$$(47) \times (48) =$$

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

$$((50) \times (51) \times (52) \times (53) =$$

0 (54)

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	0	(56)
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If cylinder contains dedicated solar storage, $(57)m = (56)m \times ((50) - (H11)) + (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
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0 (58)

Primary circuit loss (annual) from Table 3

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

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

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

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

(61)m=	42.23	36.75	39.16	36.41	36.09	33.44	34.55	36.09	36.41	39.16	39.38	42.23	(61)
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SAP WorkSheet: New dwelling design stage

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

(62)m=	165.41	144.49	150.33	133.33	129.09	113.69	108.92	121.42	122.76	139.8	149.24	161.52	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
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Output from water heater

(64)m=	165.41	144.49	150.33	133.33	129.09	113.69	108.92	121.42	122.76	139.8	149.24	161.52	
Output from water heater (annual) _{1,12}												1640.0045	(64)

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

(65)m=	51.52	45.01	46.75	41.33	39.94	35.04	33.36	37.4	37.82	43.25	46.37	50.22	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	94.4	94.4	94.4	94.4	94.4	94.4	94.4	94.4	94.4	94.4	94.4	94.4	(66)

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

(67)m=	30.5	27.09	22.03	16.68	12.47	10.53	11.37	14.79	19.84	25.2	29.41	31.35	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	204.27	206.39	201.05	189.68	175.32	161.83	152.82	150.7	156.04	167.41	181.77	195.26	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.01	46.01	46.01	46.01	46.01	46.01	46.01	46.01	46.01	46.01	46.01	46.01	(69)
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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=	-62.93	-62.93	-62.93	-62.93	-62.93	-62.93	-62.93	-62.93	-62.93	-62.93	-62.93	-62.93	(71)
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Water heating gains (Table 5)

(72)m=	69.24	66.98	62.84	57.4	53.69	48.67	44.84	50.26	52.52	58.13	64.41	67.5	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	391.5	387.94	373.41	351.24	328.96	308.51	296.52	303.23	315.89	338.22	363.06	381.59	(73)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

Solar gains are calculated using equation 6.10

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
East	0.9x	2	x	1.44	x	19.87	x	0.63	x	0.7	=	17.49	(76)
East	0.9x	1	x	2.73	x	19.87	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	2	x	1.44	x	38.52	x	0.63	x	0.7	=	33.9	(76)
East	0.9x	1	x	2.73	x	38.52	x	0.63	x	0.7	=	32.14	(76)
East	0.9x	2	x	1.44	x	61.57	x	0.63	x	0.7	=	54.19	(76)
East	0.9x	1	x	2.73	x	61.57	x	0.63	x	0.7	=	51.37	(76)
East	0.9x	2	x	1.44	x	91.41	x	0.63	x	0.7	=	80.46	(76)
East	0.9x	1	x	2.73	x	91.41	x	0.63	x	0.7	=	76.27	(76)

SAP WorkSheet: New dwelling design stage

East	0.9x	2	x	1.44	x	111.22	x	0.63	x	0.7	=	97.89	(76)
East	0.9x	1	x	2.73	x	111.22	x	0.63	x	0.7	=	92.79	(76)
East	0.9x	2	x	1.44	x	116.05	x	0.63	x	0.7	=	102.15	(76)
East	0.9x	1	x	2.73	x	116.05	x	0.63	x	0.7	=	96.82	(76)
East	0.9x	2	x	1.44	x	112.64	x	0.63	x	0.7	=	99.14	(76)
East	0.9x	1	x	2.73	x	112.64	x	0.63	x	0.7	=	93.98	(76)
East	0.9x	2	x	1.44	x	98.03	x	0.63	x	0.7	=	86.29	(76)
East	0.9x	1	x	2.73	x	98.03	x	0.63	x	0.7	=	81.79	(76)
East	0.9x	2	x	1.44	x	73.6	x	0.63	x	0.7	=	64.78	(76)
East	0.9x	1	x	2.73	x	73.6	x	0.63	x	0.7	=	61.41	(76)
East	0.9x	2	x	1.44	x	46.91	x	0.63	x	0.7	=	41.29	(76)
East	0.9x	1	x	2.73	x	46.91	x	0.63	x	0.7	=	39.14	(76)
East	0.9x	2	x	1.44	x	24.71	x	0.63	x	0.7	=	21.75	(76)
East	0.9x	1	x	2.73	x	24.71	x	0.63	x	0.7	=	20.61	(76)
East	0.9x	2	x	1.44	x	16.39	x	0.63	x	0.7	=	14.43	(76)
East	0.9x	1	x	2.73	x	16.39	x	0.63	x	0.7	=	13.68	(76)
South	0.9x	0.77	x	8.19	x	47.32	x	0.63	x	0.7	=	118.45	(78)
South	0.9x	0.77	x	8.19	x	77.18	x	0.63	x	0.7	=	193.19	(78)
South	0.9x	0.77	x	8.19	x	94.25	x	0.63	x	0.7	=	235.9	(78)
South	0.9x	0.77	x	8.19	x	105.11	x	0.63	x	0.7	=	263.1	(78)
South	0.9x	0.77	x	8.19	x	108.55	x	0.63	x	0.7	=	271.7	(78)
South	0.9x	0.77	x	8.19	x	108.9	x	0.63	x	0.7	=	272.57	(78)
South	0.9x	0.77	x	8.19	x	107.14	x	0.63	x	0.7	=	268.16	(78)
South	0.9x	0.77	x	8.19	x	103.88	x	0.63	x	0.7	=	260.02	(78)
South	0.9x	0.77	x	8.19	x	99.99	x	0.63	x	0.7	=	250.27	(78)
South	0.9x	0.77	x	8.19	x	85.29	x	0.63	x	0.7	=	213.48	(78)
South	0.9x	0.77	x	8.19	x	56.07	x	0.63	x	0.7	=	140.34	(78)
South	0.9x	0.77	x	8.19	x	40.89	x	0.63	x	0.7	=	102.35	(78)

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

(83)m=	152.52	259.23	341.45	419.82	462.38	471.54	461.28	428.09	376.47	293.91	182.7	130.45	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

(84)m=	544.02	647.17	714.85	771.06	791.34	780.05	757.8	731.32	692.35	632.13	545.76	512.05	(84)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

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

21	(85)
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Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.93	0.88	0.77	0.61	0.43	0.44	0.69	0.88	0.96	0.98	(86)

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

(87)m=	19.28	19.56	19.93	20.32	20.7	20.91	20.98	20.98	20.85	20.43	19.75	19.33	(87)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.35	19.38	19.38	19.43	19.46	19.48	19.49	19.49	19.45	19.43	19.41	19.38	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

SAP WorkSheet: New dwelling design stage

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

(89)m=	0.97	0.95	0.91	0.84	0.7	0.49	0.28	0.29	0.58	0.83	0.95	0.97	(89)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

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

(90)m=	17.89	18.19	18.54	18.94	19.28	19.44	19.49	19.49	19.39	19.05	18.39	17.96	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area + (4) = 0.67 (91)

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

(92)m=	18.83	19.11	19.47	19.87	20.24	20.43	20.49	20.49	20.37	19.98	19.3	18.89	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

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

(93)m=	18.83	19.11	19.47	19.87	20.24	20.43	20.49	20.49	20.37	19.98	19.3	18.89	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

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

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

Utilisation factor for gains, hm:

(94)m=	0.97	0.95	0.91	0.85	0.74	0.57	0.38	0.39	0.65	0.85	0.95	0.97	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	526.52	612.28	650.63	657.55	584.55	445.33	288.29	287.49	449.98	539.5	518.29	496.96	(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)
--------	-----	---	-----	-----	------	------	------	------	------	------	---	-----	------

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

(97)m=	1304.8	1259.11	1130.66	958.28	714.92	482.59	294.35	294.23	511.54	787.35	1075.99	1247.71	(97)
--------	--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	579.04	434.67	357.14	216.52	96.99	0	0	0	0	184.4	401.54	558.55	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...12} = 2828.86 (96)

Space heating requirement in kWh/m²/year

61.5 (99)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

89.9 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

kWh/year

Space heating requirement (calculated above)

579.04	434.67	357.14	216.52	96.99	0	0	0	0	184.4	401.54	558.55
--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] + (210)m} x 100 ÷ (206) (211)

644.09	483.5	397.27	240.85	107.89	0	0	0	0	205.12	446.66	621.31
--------	-------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1...12} = 3146.68 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214)m} x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	(215)
---------	---	---	---	---	---	---	---	---	---	---	---	-------

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

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

165.41	144.49	150.33	133.33	129.09	113.69	108.92	121.42	122.76	139.8	149.24	161.52
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Efficiency of water heater

79.8 (216)

(217)m=	87.44	87.15	86.65	85.76	83.84	79.8	79.8	79.8	79.8	85.25	86.92	87.42
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	189.17	165.8	173.49	155.47	153.97	142.47	136.49	152.16	153.84	163.99	171.69	184.77
---------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{L12} =

1943.3 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3146.68

Water heating fuel used

1943.3

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

215.48

(232)

NOTE: The above figures are for the design stage only. For the final stage, the figures should be based on the actual usage of the dwelling.

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.1	97.547 (240)
Space heating - main system 2	(213) x	0	0 (241)
Space heating - secondary	(215) x	0	0 (242)
Water heating cost (other fuel)	(219)	3.1	60.24 (247)
Pumps, fans and electric keep-hot	(231)	11.46	20.06 (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	24.69 (250)
Additional standing charges (Table 12)			106 (251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost

(245)...(247) + (250)...(254) =

308.5383 (255)

NOTE: The above figures are for the design stage only. For the final stage, the figures should be based on the actual usage of the dwelling.

Energy cost deflator (Table 12)

0.47

(256)

Energy cost factor (ECF)

[(255) x (256)] ÷ [(4) + 45.0] =

1.5935

(257)

SAP rating (Section 12)

77.77

(258)

NOTE: The above figures are for the design stage only. For the final stage, the figures should be based on the actual usage of the dwelling.

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.198	623.04 (261)

SAP WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0	=	0	(263)
Water heating	(219) x	0.198	=	384.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1007.82	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48	(267)
Electricity for lighting	(232) x	0.517	=	111.4	(268)
Total CO2, kg/year		sum of (265)...(271) =		1209.69	(272)
CO2 emissions per m²		(272) ÷ (4) =		26.3	(273)
EI rating (section 14)				82	(274)

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	Energy kWh/year	Primary factor	=	P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.02	=	3209.61	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	1982.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5191.78	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	629.2	(268)
Total Primary Energy		sum of (265)...(271) =		6331.98	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		137.65	(273)

Predicted Energy Assessment



Plot 3
3 Marine Drive West
Bognor Regis
PO21

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

Enclosed end Ground floor Flat
08 August 2013
Ondrej Gajdos
41 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.

Energy Efficiency Rating	Environmental Impact (CO ₂) Rating
Very energy efficient - lower running costs A B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not energy efficient - higher running costs 81	Very environmentally friendly - lower CO₂ emissions (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E F G Not environmentally friendly - higher CO₂ emissions 83
England & Wales EU Directive 2002/91/EC	England & Wales EU Directive 2002/91/EC

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.

SAP WorkSheet: New dwelling design stage

Assessor Name: Ondrej Gajdos

Stroma Number:

STRO006629

Software Name: Stroma FSAP 2009

Software Version:

Version: 1.5.0.49

Address : Plot 3, 3 Marine Drive West, Bognor Regis, PO21

	Area(m²)		Ave Height(m)		Volume(m³)
Ground floor	41	(1a) x	2.55	(2a) =	104.55 (3a)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) 41 (4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = 104.55 (5)

	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				2	x 10 =	20 (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) = 20 + (5) = 0.19 (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 15 (17)

If based on air permeability value, then (18) = [(17) + 20]÷(8), otherwise (18) = (16) 0.94 (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 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.73 (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
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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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SAP WorkSheet: New dwelling design stage

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

0.98	0.93	0.93	0.82	0.75	0.71	0.67	0.67	0.77	0.82	0.88	0.93
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) + 100]

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

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

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

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

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

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

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m = 0.98 0.93 0.93 0.84 0.78 0.75 0.73 0.73 0.79 0.84 0.88 0.93 (24d)

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

(25)m = 0.98 0.93 0.93 0.84 0.78 0.75 0.73 0.73 0.79 0.84 0.88 0.93 (25)

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 2.52 x 1.5 = 3.78 (26)

Windows Type 1 1.42 x 1/[1/(1.5) + 0.04] = 2.01 (27)

Windows Type 2 6.09 x 1/[1/(1.5) + 0.04] = 8.62 (27)

Floor 41 x 0.2 = 8.2 (28)

Walls Type1 30.6 5.36 25.24 x 0.25 = 6.31 (29)

Walls Type2 4.08 0 4.08 x 0.27 = 1.09 (29)

Walls Type3 13.26 6.09 7.17 x 0.25 = 1.79 (29)

Roof 7 0 7 x 0.15 = 1.05 (30)

Total area of elements, m² 95.94 (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) = 34.86 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 14.39 (36)

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

Total fabric heat loss (33) + (36) = 49.25 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m =	33.98	32.17	32.17	28.87	26.9	25.98	25.11	25.11	27.37	28.87	30.47	32.17

(38)

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

(39)m =	83.23	81.42	81.42	78.12	76.14	75.22	74.35	74.35	76.62	78.12	79.72	81.42
---------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

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SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	2.03	1.99	1.99	1.91	1.86	1.83	1.81	1.81	1.87	1.91	1.94	1.99	
Average = Sum(40) _{1...12} / 12 =													1.91

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)

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

1.4332 (42)

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

71.829 (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=	79.01	76.14	73.27	70.39	67.52	64.65	64.65	67.52	70.39	73.27	76.14	79.01	
Total = Sum(44) _{1...12} =													861.9484

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=	117.45	102.72	106	92.42	88.68	76.52	70.91	81.37	82.34	95.96	104.75	113.75	
Total = Sum(45) _{1...12} =													1132.854

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

(46)m=	17.62	15.41	15.9	13.86	13.3	11.48	10.64	12.2	12.35	14.39	15.71	17.06	(46)
--------	-------	-------	------	-------	------	-------	-------	------	-------	-------	-------	-------	------

Water storage loss:

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

1.38 (47)

Temperature factor from Table 2b

0.54 (48)

Energy lost from water storage, kWh/year

$$(47) \times (48) =$$

0.7452 (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

$$((50) \times (51) \times (52) \times (53) =$$

0 (54)

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

0.7452 (55)

Water storage loss calculated for each month

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

(56)m=	23.1	20.87	23.1	22.36	23.1	22.36	23.1	23.1	22.36	23.1	22.36	23.1	(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=	23.1	20.87	23.1	22.36	23.1	22.36	23.1	23.1	22.36	23.1	22.36	23.1	(57)
--------	------	-------	------	-------	------	-------	------	------	-------	------	-------	------	------

360 (58)

Primary circuit loss (annual) from Table 3

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

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

(59)m=	30.58	27.62	30.58	29.59	30.58	0	0	0	0	30.58	29.59	30.58	(59)
--------	-------	-------	-------	-------	-------	---	---	---	---	-------	-------	-------	------

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

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

SAP WorkSheet: New dwelling design stage

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

(62)m=	171.13	151.21	159.68	144.36	142.35	98.88	94.01	104.47	104.69	149.63	156.69	167.42	(62)
--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------	------

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

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

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

Output from water heater

(64)m=	171.13	151.21	159.68	144.36	142.35	0	0	0	0	149.63	156.69	167.42	
Output from water heater (annual) $\sum_{1..12}$												1242.4763	(64)

Output immersion

(64)m=	0	0	0	0	0	98.88	94.01	104.47	104.69	0	0	0	
Output from immersion (annual) $\sum_{1..12}$												402.0469	(64)

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

(65)m=	81.99	72.94	78.19	72.28	72.43	43.33	42.06	45.54	45.26	74.85	76.38	80.76	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	(66)

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

(67)m=	27.65	24.56	19.97	15.12	11.3	9.54	10.31	13.4	17.99	22.84	26.66	28.42	(67)
--------	-------	-------	-------	-------	------	------	-------	------	-------	-------	-------	-------	------

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

(68)m=	185.16	187.08	182.24	171.93	158.92	146.69	138.52	136.6	141.44	151.75	164.76	176.99	(68)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	(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=	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	110.21	108.54	105.09	100.39	97.35	60.18	56.53	61.2	62.86	100.6	106.09	108.55	(72)
--------	--------	--------	--------	--------	-------	-------	-------	------	-------	-------	--------	--------	------

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

(73)m=	406.71	403.88	391	371.14	351.26	300.1	289.06	294.9	305.99	358.88	381.2	397.65	(73)
--------	--------	--------	-----	--------	--------	-------	--------	-------	--------	--------	-------	--------	------

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)	
North	0.9x 0.77	x 6.09	x 10.73	x 0.63	x 0.7	= 19.96	(74)
North	0.9x 0.77	x 6.09	x 20.36	x 0.63	x 0.7	= 37.89	(74)
North	0.9x 0.77	x 6.09	x 33.31	x 0.63	x 0.7	= 61.99	(74)
North	0.9x 0.77	x 6.09	x 54.64	x 0.63	x 0.7	= 101.69	(74)
North	0.9x 0.77	x 6.09	x 75.22	x 0.63	x 0.7	= 139.99	(74)

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North	0.9x	0.77	x	6.09	x	84.09	x	0.63	x	0.7	=	156.51	(74)
North	0.9x	0.77	x	6.09	x	79.12	x	0.63	x	0.7	=	147.26	(74)
North	0.9x	0.77	x	6.09	x	61.56	x	0.63	x	0.7	=	114.58	(74)
North	0.9x	0.77	x	6.09	x	41.09	x	0.63	x	0.7	=	76.47	(74)
North	0.9x	0.77	x	6.09	x	24.81	x	0.63	x	0.7	=	46.18	(74)
North	0.9x	0.77	x	6.09	x	13.22	x	0.63	x	0.7	=	24.6	(74)
North	0.9x	0.77	x	6.09	x	8.94	x	0.63	x	0.7	=	16.65	(74)
West	0.9x	0.77	x	1.42	x	19.87	x	0.63	x	0.7	=	17.25	(80)
West	0.9x	0.77	x	1.42	x	38.52	x	0.63	x	0.7	=	33.43	(80)
West	0.9x	0.77	x	1.42	x	61.57	x	0.63	x	0.7	=	53.43	(80)
West	0.9x	0.77	x	1.42	x	91.41	x	0.63	x	0.7	=	79.34	(80)
West	0.9x	0.77	x	1.42	x	111.22	x	0.63	x	0.7	=	96.53	(80)
West	0.9x	0.77	x	1.42	x	116.05	x	0.63	x	0.7	=	100.73	(80)
West	0.9x	0.77	x	1.42	x	112.64	x	0.63	x	0.7	=	97.77	(80)
West	0.9x	0.77	x	1.42	x	98.03	x	0.63	x	0.7	=	85.09	(80)
West	0.9x	0.77	x	1.42	x	73.6	x	0.63	x	0.7	=	63.88	(80)
West	0.9x	0.77	x	1.42	x	46.91	x	0.63	x	0.7	=	40.71	(80)
West	0.9x	0.77	x	1.42	x	24.71	x	0.63	x	0.7	=	21.44	(80)
West	0.9x	0.77	x	1.42	x	16.39	x	0.63	x	0.7	=	14.23	(80)

Solar gains in watts, calculated for each month

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

(83)m=	37.21	71.32	115.43	181.03	236.52	257.23	245.02	199.67	140.35	86.9	46.05	30.88	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	------	-------	-------	------

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

(84)m=	443.92	475.2	506.42	552.17	587.79	557.34	534.08	494.57	446.34	445.78	427.25	428.53	(84)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

21 (85)

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

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	0.98	0.98	0.96	0.93	0.84	0.72	0.53	0.57	0.83	0.93	0.98	0.98	

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)
--------	----	----	----	----	----	----	----	----	----	----	----	----	------

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

(88)m=	19.32	19.35	19.35	19.4	19.44	19.45	19.47	19.47	19.43	19.4	19.38	19.35	(88)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(89)m=	0.98	0.97	0.95	0.9	0.78	0.6	0.35	0.38	0.72	0.9	0.97	0.98	(89)
--------	------	------	------	-----	------	-----	------	------	------	-----	------	------	------

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

(90)m=	19.32	19.35	19.35	19.4	19.44	19.45	19.47	19.47	19.43	19.4	19.38	19.35	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area + (4) =

0.56 (91)

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

(92)m=	20.26	20.28	20.28	20.3	20.31	20.32	20.33	20.33	20.31	20.3	20.29	20.28	(92)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(93)m=	20.26	20.28	20.28	20.3	20.31	20.32	20.33	20.33	20.31	20.3	20.29	20.28	(93)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	------

SAP WorkSheet: New dwelling design stage

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

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

Utilisation factor for gains, hm :

(94)m=	0.98	0.97	0.96	0.92	0.82	0.67	0.46	0.49	0.79	0.92	0.97	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	435.44	463.11	484.91	507.77	480.77	373.13	244.82	242.47	351.98	411.16	415.19	420.53	(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	1311.89	1243.73	1097.17	906.07	655.84	430.29	254.77	254.77	460.47	742.02	1059.23	1251.87	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	652.08	524.58	455.52	286.77	130.25	0	0	0	0	246.16	463.72	618.52	
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 3377.6 (98)

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

82.38 (99)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

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

1 (202)

Fraction of total heating from main system 1

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

1 (204)

Efficiency of main space heating system 1

363 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

652.08	524.58	455.52	286.77	130.25	0	0	0	0	246.16	463.72	618.52	
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	--

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

179.63	144.51	125.49	79	35.88	0	0	0	0	67.81	127.74	170.39	
--------	--------	--------	----	-------	---	---	---	---	-------	--------	--------	--

Total ($kWh/year$) = $Sum(211)_{1..12} =$ 930.46 (211)

Space heating fuel (secondary), $kWh/month$

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

(215)m=	0	0	0	0	0	0	0	0	0	0	0	
---------	---	---	---	---	---	---	---	---	---	---	---	--

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

Water heating

Output from water heater (calculated above)

171.13	151.21	159.68	144.36	142.35	0	0	0	0	149.63	156.69	167.42	
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	--

195.98 (216)

Efficiency of water heater

(217)m= 195.98 195.98 195.98 195.98 195.98 195.98 195.98 195.98 195.98 195.98 195.98 195.98 (217)

Fuel for water heating, $kWh/month$

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

(219)m=	87.32	77.15	81.48	73.66	72.63	0	0	0	0	76.35	79.95	85.43	
---------	-------	-------	-------	-------	-------	---	---	---	---	-------	-------	-------	--

Total = $Sum(219a)_{1..12} =$ 633.96 (219)

Water heating requirement (immersion)

0	0	0	0	0	98.88	94.01	104.47	104.69	0	0	0	
---	---	---	---	---	-------	-------	--------	--------	---	---	---	--

100 (216)

Efficiency of water heater (Immersion)

SAP WorkSheet: New dwelling design stage

(217)m=	0	0	0	0	0	100	100	100	100	0	0	0	(217)
Fuel for water heating (Immersion), kWh/month													
(219)m = [(64)m + (218) m] x 100 ÷ (217)m													
(219)m=	0	0	0	0	0	98.88	94.01	104.47	104.69	0	0	0	
Total = Sum(219a) ₁₋₁₂ =													402.05 (219)

Annual totals

Space heating fuel used, main system 1

Water heating fuel used

Water heating fuel used (Immersion)

Electricity for pumps, fans and electric keep-hot

Total electricity for the above, kWh/year

Electricity for lighting

kWh/year

kWh/year

930.46

633.96

402.05

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

0 (231)

195.32 (232)

Fuel
kWh/year

Fuel Price
(Table 12)

Fuel Cost
£/year

Space heating - main system 1

(211) x

11.46

x 0.01 =

106.6304 (240)

Space heating - main system 2

(213) x

0

x 0.01 =

0 (241)

Space heating - secondary

(215) x

0

x 0.01 =

0 (242)

Water heating cost (other fuel)

(219)

11.46

x 0.01 =

72.65 (247)

Water heating cost (Immersion)

(219)

11.46

x 0.01 =

46.07 (247)

Pumps, fans and electric keep-hot

(231)

11.46

x 0.01 =

0 (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 =

22.38 (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) =

247.7408 (255)

Energy cost deflator (Table 12)

0.47 (256)

Energy cost factor (ECF)

[(255) x (256)] ÷ [(4) + 45.0] =

1.3539 (257)

SAP rating (Section 12)

81.1126 (258)

Energy
kWh/year

Emission factor
kg CO2/kWh

Emissions
kg CO2/year

Space heating (main system 1)

(211) x

0.517

=

481.05 (261)

Space heating (secondary)

(215) x

0

=

0 (263)

Water heating

(219) x

0.517

=

327.76 (264)

Water heating (Immersion)

(219) x

0.517

=

207.86 (264)

SAP WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =			1016.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) ×	0.517	=	0	(267)
Electricity for lighting	(232) ×	0.517	=	100.98	(268)
Total CO2, kg/year	sum of (265)...(271) =			1117.64	(272)
CO2 emissions per m ²	(272) ÷ (4) =			27.26	(273)
EI rating (section 14)				83	(274)

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	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) ×	2.92	=	2716.93	(261)
Space heating (secondary)	(215) ×	0	=	0	(263)
Energy for water heating	(219) ×	2.92	=	1851.18	(264)
Energy for water heating (Immersion)	(219) ×	2.92	=	1173.98	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5742.09	(265)
Electricity for pumps, fans and electric keep-hot	(231) ×	2.92	=	0	(267)
Electricity for lighting	(232) ×	0	=	570.33	(268)
Total Primary Energy	sum of (265)...(271) =			6312.42	(272)
Primary energy kWh/m ² /year	(272) ÷ (4) =			153.96	(273)

Predicted Energy Assessment



Plot 4
3 Marine Drive West
Bognor Regis
PO21

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

Enclosed end Ground floor Flat
08 August 2013
Ondrej Gajdos
40 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.

Energy Efficiency Rating	Environmental Impact (CO ₂) Rating
Very energy efficient - lower running costs (92-100) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not energy efficient - higher running costs 81 England & Wales EU Directive 2002/91/EC	Very environmentally friendly - lower CO₂ emissions (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not environmentally friendly - higher CO₂ emissions 83 England & Wales EU Directive 2002/91/EC

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.

SAP WorkSheet: New dwelling design stage

Assessor Name: Ondrej Gajdos
Software Name: Stroma FSAP 2009

Stroma Number:
Software Version:

STRO006629
 Version: 1.5.0.49

Address : Plot 4, 3 Marine Drive West, Bognor Regis, PO21

	Area(m ²)	Ave Height(m)	Volume(m ³)
Ground floor	40 (1a)	2.55 (2a)	102 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	40 (4)		
Dwelling volume			102 (5)

	main heating	Secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0.2 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) = 0 (9)
 Additional infiltration = 0 (10)
 Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

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

If no draught lobby, enter 0.05, else enter 0

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 = 15 (17)

If based on air permeability value, then (18) = [(17) + 20] x (8), otherwise (18) = (16) = 0.95 (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 = 3 (19)

Shelter factor = 0.78 (20)

Infiltration rate incorporating shelter factor = 0.73 (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
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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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SAP WorkSheet: New dwelling design stage

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

0.99	0.93	0.93	0.82	0.75	0.71	0.68	0.68	0.77	0.82	0.88	0.93
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

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

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

0 (23a)

0 (23b)

0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	(24a)
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	(24b)
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	(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=	0.99	0.94	0.94	0.84	0.78	0.76	0.73	0.73	0.8	0.84	0.89	0.94	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.99	0.94	0.94	0.84	0.78	0.76	0.73	0.73	0.8	0.84	0.89	0.94	(25)
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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			2.52	1.5	3.78			(26)
Windows Type 1			1.44	1/(1/1.5 + 0.04)	2.04			(27)
Windows Type 2			6.09	1/(1/1.5 + 0.04)	8.62			(27)
Floor			40	0.2	8			(28)
Walls Type1	25.5	5.4	20.1	0.25	5.02			(29)
Walls Type2	5.86	0	5.86	0.27	1.56			(29)
Walls Type3	16.32	6.09	10.23	0.25	2.56			(29)
Roof	7	0	7	0.15	1.05			(30)
Total area of elements, m²			94.685					(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) = 34.67 (33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) = 0 (34)

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

Indicative Value: Medium 250 (35)

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

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

14.2 (36)

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

Total fabric heat loss

(33) + (36) = 48.87 (37)

Ventilation heat loss calculated monthly

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

(38)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	33.32	31.54	31.54	28.28	26.34	25.43	24.57	24.57	26.81	28.28	29.86	31.54	(38)

Heat transfer coefficient, W/K

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

(39)m=	82.19	80.41	80.41	77.15	75.21	74.3	73.44	73.44	75.67	77.15	78.73	80.41	
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Average = Sum(39)...12/ = 77.3 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	2.05	2.01	2.01	1.93	1.88	1.86	1.84	1.84	1.89	1.93	1.97	2.01		(40)
Average = Sum(40) _{1..12} / 12 =													1.93	

Number of days in month (Table 1a)

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

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

1.4063

(42)

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

71.1584

(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=	78.27	75.43	72.58	69.74	66.89	64.04	64.04	66.89	69.74	72.58	75.43	78.27	853.9007	(44)
Total = Sum(44) _{1..12} =														

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=	116.36	101.77	105.01	91.55	87.85	75.81	70.24	80.61	81.57	95.06	103.77	112.68	1122.2771	(45)
Total = Sum(45) _{1..12} =														

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

(46)m=	17.45	15.26	15.75	13.73	13.18	11.37	10.54	12.09	12.24	14.26	15.57	16.9		(46)
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Water storage loss:

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

1.38

(47)

Temperature factor from Table 2b

0.54

(48)

Energy lost from water storage, kWh/year

$$(47) \times (48) =$$

0.7452

(49)

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

0

(50)

Cylinder volume (litres) including any solar storage within same

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

$$((50) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.7452

(55)

Water storage loss calculated for each month

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

(56)m=	23.1	20.87	23.1	22.36	23.1	22.36	23.1	23.1	22.36	23.1	22.36	23.1		(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=	23.1	20.87	23.1	22.36	23.1	22.36	23.1	23.1	22.36	23.1	22.36	23.1	360	(57)
														(58)

Primary circuit loss (annual) from Table 3

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	0	0	0	0	30.58	29.59	30.58		(59)
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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

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

SAP WorkSheet: New dwelling design stage

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

(62)m=	170.03	150.25	158.69	143.5	141.52	98.16	93.35	103.71	103.93	148.74	155.71	166.36	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

Output from water heater

(64)m=	170.03	150.25	158.69	143.5	141.52	0	0	0	0	148.74	155.71	166.36	(64)
Output from water heater (annual) _{1...12}												1234.8043	(64)

Output immersion

(64)m=	0	0	0	0	0	98.16	93.35	103.71	103.93	0	0	0	(64)
Output from immersion (annual) _{1...12}												399.142	(64)

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

(65)m=	81.63	72.62	77.86	72	72.15	43.09	41.84	45.28	45.01	74.55	76.06	80.41	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.38	84.38	84.38	84.38	84.38	84.38	84.38	84.38	84.38	84.38	84.38	84.38	(66)

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

(67)m=	27.09	24.06	19.57	14.81	11.07	9.35	10.1	13.13	17.62	22.38	26.12	27.84	(67)
--------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------

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

(68)m=	181.39	183.28	178.53	168.43	155.69	143.71	135.7	133.82	138.56	148.66	161.41	173.39	(68)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

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

(69)m=	44.84	44.84	44.84	44.84	44.84	44.84	44.84	44.84	44.84	44.84	44.84	44.84	(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=	-56.25	-56.25	-56.25	-56.25	-56.25	-56.25	-56.25	-56.25	-56.25	-56.25	-56.25	-56.25	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	109.72	108.07	104.65	100	96.98	59.85	56.23	60.86	62.51	100.2	105.64	108.08	(72)
--------	--------	--------	--------	-----	-------	-------	-------	-------	-------	-------	--------	--------	------

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

(73)m=	401.17	398.37	385.72	366.21	346.71	295.87	285.01	290.79	301.67	354.21	376.13	392.28	(73)
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Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Solar gains are calculated using solar flux from Table 6a and direction from Table 6b													
Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g _s Table 6b		FF Table 6c		Gains (W)		
North	0.9x	0.77	x	6.09	x	10.73	x	0.63	x	0.7	=	19.96	(74)
North	0.9x	0.77	x	6.09	x	20.36	x	0.63	x	0.7	=	37.89	(74)
North	0.9x	0.77	x	6.09	x	33.31	x	0.63	x	0.7	=	61.99	(74)
North	0.9x	0.77	x	6.09	x	54.64	x	0.63	x	0.7	=	101.69	(74)
North	0.9x	0.77	x	6.09	x	75.22	x	0.63	x	0.7	=	139.99	(74)

SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	6.09	x	84.09	x	0.63	x	0.7	=	156.51	(74)
North	0.9x	0.77	x	6.09	x	79.12	x	0.63	x	0.7	=	147.26	(74)
North	0.9x	0.77	x	6.09	x	61.56	x	0.63	x	0.7	=	114.58	(74)
North	0.9x	0.77	x	6.09	x	41.09	x	0.63	x	0.7	=	76.47	(74)
North	0.9x	0.77	x	6.09	x	24.81	x	0.63	x	0.7	=	46.18	(74)
North	0.9x	0.77	x	6.09	x	13.22	x	0.63	x	0.7	=	24.6	(74)
North	0.9x	0.77	x	6.09	x	8.94	x	0.63	x	0.7	=	16.65	(74)
West	0.9x	0.77	x	1.44	x	19.87	x	0.63	x	0.7	=	17.49	(80)
West	0.9x	0.77	x	1.44	x	38.52	x	0.63	x	0.7	=	33.9	(80)
West	0.9x	0.77	x	1.44	x	61.57	x	0.63	x	0.7	=	54.19	(80)
West	0.9x	0.77	x	1.44	x	91.41	x	0.63	x	0.7	=	80.46	(80)
West	0.9x	0.77	x	1.44	x	111.22	x	0.63	x	0.7	=	97.89	(80)
West	0.9x	0.77	x	1.44	x	116.05	x	0.63	x	0.7	=	102.15	(80)
West	0.9x	0.77	x	1.44	x	112.64	x	0.63	x	0.7	=	99.14	(80)
West	0.9x	0.77	x	1.44	x	98.03	x	0.63	x	0.7	=	86.29	(80)
West	0.9x	0.77	x	1.44	x	73.6	x	0.63	x	0.7	=	64.78	(80)
West	0.9x	0.77	x	1.44	x	46.91	x	0.63	x	0.7	=	41.29	(80)
West	0.9x	0.77	x	1.44	x	24.71	x	0.63	x	0.7	=	21.75	(80)
West	0.9x	0.77	x	1.44	x	16.39	x	0.63	x	0.7	=	14.43	(80)

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

(83)m= 37.46 71.79 116.18 182.15 237.88 258.65 246.4 200.87 141.25 87.47 46.35 31.08

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

(84)m= 438.62 470.17 501.9 548.36 584.59 554.52 531.41 491.66 442.92 441.68 422.48 423.35

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

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

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.98	0.98	0.96	0.93	0.84	0.71	0.53	0.57	0.82	0.93	0.97	0.98

(86)

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

(87)m= 21 21 21 21 21 21 21 21 21 21 21 21 (87)

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

(88)m= 19.3 19.33 19.33 19.39 19.42 19.44 19.45 19.45 19.41 19.39 19.36 19.33 (88)

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

(89)m= 0.98 0.97 0.95 0.9 0.77 0.59 0.35 0.37 0.72 0.9 0.96 0.98 (89)

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

(90)m= 19.3 19.33 19.33 19.39 19.42 19.44 19.45 19.45 19.41 19.39 19.36 19.33 (90)

fLA = Living area + (4) = 0.57 (91)

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

(92)m= 20.28 20.29 20.29 20.31 20.33 20.34 20.34 20.34 20.33 20.31 20.3 20.29 (92)

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

(93)m= 20.28 20.29 20.29 20.31 20.33 20.34 20.34 20.34 20.33 20.31 20.3 20.29 (93)

SAP WorkSheet: New dwelling design stage

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, h_m :													(94)
(94)m=	0.98	0.97	0.96	0.92	0.81	0.67	0.46	0.49	0.79	0.92	0.97	0.98	
Useful gains, $h_m G_m$, $W = (94)m \times (84)m$													(95)
(95)m=	430	457.84	479.96	503.08	476.18	369.43	242.72	240.34	348.24	406.67	410.23	415.22	
Monthly average external temperature from Table 8													(96)
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	
Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times (93)m - (96)m]$													(97)
(97)m=	1296.89	1229.57	1084.84	896.08	648.92	426.13	252.75	252.75	455.96	734.06	1047.36	1237.61	
Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$													
(98)m=	644.96	518.6	450.03	282.96	128.52	0	0	0	0	243.58	458.74	611.86	
Total per year ($kWh/year$) = $Sum(98)_{1..12} =$												3339.25	(98)
												83.48	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

Fraction of space heat from main system(s)

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

Fraction of total heating from main system 1

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

Efficiency of main space heating system 1

Efficiency of secondary/supplementary heating system, %

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	$kWh/year$	
Space heating requirement (calculated above)														
(211)m = $\{[(98)m \times (204)] + (210)m\} \times 100 \div (206)$														(211)
(211)m=	177.9	143.05	124.13	78.05	35.45	0	0	0	0	67.19	126.53	168.77		
Total ($kWh/year$) = $Sum(211)_{1..12} =$												921.07	(211)	

Space heating fuel (secondary), $kWh/month$

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

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

Water heating

Output from water heater (calculated above)

	170.03	150.25	158.69	143.5	141.52	0	0	0	0	148.74	155.71	166.36		
Efficiency of water heater													195.98	(216)

Efficiency of water heater

(217)m=	195.98	195.98	195.98	195.98	195.98	195.98	195.98	195.98	195.98	195.98	195.98	195.98		(217)
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--	-------

Fuel for water heating, $kWh/month$

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

(219)m=	86.76	76.66	80.97	73.22	72.21	0	0	0	0	75.89	79.45	84.88		(219)
Total = $Sum(219a)_{1..12} =$												630.05		

Water heating requirement (immersion)

	0	0	0	0	0	98.16	93.35	103.71	103.93	0	0	0		(216)
Efficiency of water heater (Immersion)													100	

SAP WorkSheet: New dwelling design stage

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

Fuel for water heating (Immersion), kWh/month

(219)m = $\lceil (64)m + (218)m \rceil \times 100 \div (217)m$

(219)m=	0	0	0	0	0	98.16	93.35	103.71	103.93	0	0	0	
Total = Sum(219a)...(219i) =												399.14	(219)

kWh/year

kWh/year

Annual totals

Space heating fuel used, main system 1

921.07

Water heating fuel used

630.05

Water heating fuel used (Immersion)

399.14

Electricity for pumps, fans and electric keep-hot

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

0

(231)

Total electricity for the above, kWh/year

191.35

(232)

Electricity for lighting

Electricity for lighting (Table 12)

Fuel
kWh/year

Fuel Price
(Table 12)

Fuel Cost
£/year

Space heating - main system 1

(211) x

11.46

x 0.01 =

105.5542

(240)

Space heating - main system 2

(213) x

0

x 0.01 =

0

(241)

Space heating - secondary

(215) x

0

x 0.01 =

0

(242)

Water heating cost (other fuel)

(219)

11.46

x 0.01 =

72.2

(247)

Water heating cost (Immersion)

(219)

11.46

x 0.01 =

45.74

(247)

Pumps, fans and electric keep-hot

(231)

11.46

x 0.01 =

0

(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 =

21.93

(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) =

245.4279

(255)

Energy cost deflator (Table 12)

0.47

(256)

Energy cost factor (ECF)

$[(255) \times (256)] \div [(4) + 45.0] =$

1.3571

(257)

SAP rating (Section 12)

81.0688

(258)

Energy cost factor (ECF) (Table 12)

Energy
kWh/year

Emission factor
kg CO2/kWh

Emissions
kg CO2/year

Space heating (main system 1)

(211) x

0.517

=

476.19

(261)

Space heating (secondary)

(215) x

0

=

0

(263)

Water heating

(219) x

0.517

=

325.74

(264)

Water heating (Immersion)

(219) x

0.517

=

206.36

(264)

SAP WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =	1008.28	(265)
Electricity for pumps, fans and electric keep-hot	(231) x 0.517 =	0	(267)
Electricity for lighting	(232) x 0.517 =	98.93	(268)
Total CO2, kg/year	sum of (265)...(271) =	1107.21	(272)
CO2 emissions per m²	(272) + (4) =	27.68	(273)
El rating (section 14)		83	(274)

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x 2.92 =	2689.51	(261)
Space heating (secondary)	(215) x 0 =	0	(263)
Energy for water heating	(219) x 2.92 =	1839.75	(264)
Energy for water heating (Immersion)	(219) x 2.92 =	1165.49	(264)
Space and water heating	(261) + (262) + (263) + (264) =	5694.76	(265)
Electricity for pumps, fans and electric keep-hot	(231) x 2.92 =	0	(267)
Electricity for lighting	(232) x 0 =	558.73	(268)
Total Primary Energy	sum of (265)...(271) =	6253.49	(272)
Primary energy kWh/m²/year	(272) + (4) =	156.34	(273)

Predicted Energy Assessment

SAP

Plot 5
3 Marine Drive West
Bognor Regis
PO21

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

Enclosed end Mid floor Flat
08 August 2013
Ondrej Gajdos
48 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.

Energy Efficiency Rating	Environmental Impact (CO ₂) Rating
Very energy efficient - lower running costs (92-100) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not energy efficient - higher running costs 81	Very environmentally friendly - lower CO₂ emissions (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not environmentally friendly - higher CO₂ emissions 86
England & Wales EU Directive 2002/91/EC	England & Wales EU Directive 2002/91/EC

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.

SAP WorkSheet: New dwelling design stage

Assessor Name: Ondrej Gajdos

Stroma Number:

STRO006629

Software Name: Stroma FSAP 2009

Software Version:

Version: 1.5.0.49

Address : Plot 5, 3 Marine Drive West, Bognor Regis, PO21

Ground floor Area(m²) 48 (1a) x Ave Height(m) 2.4 (2a) = Volume(m³) 115.2 (3a)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) 48 (4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = 115.2 (5)

	main heating	Secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0.17 (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 15 (17)

If based on air permeability value, then (18) = [(17) + 20] + (8), otherwise (18) = (16) 0.92 (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 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.72 (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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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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SAP WorkSheet: New dwelling design stage

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

0.97	0.91	0.91	0.81	0.73	0.7	0.66	0.66	0.75	0.81	0.86	0.91
------	------	------	------	------	-----	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

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

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

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

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

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

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

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m = 0.97 0.92 0.92 0.82 0.77 0.74 0.72 0.72 0.78 0.82 0.87 0.92 (24d)

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

(25)m = 0.97 0.92 0.92 0.82 0.77 0.74 0.72 0.72 0.78 0.82 0.87 0.92 (25)

~~UNRECORDED SAMPLE DATA FOR ILLUSTRATION PURPOSES ONLY~~

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A, m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² ·K	A X k kJ/K
Windows Type 1			1.42	x1/[1/(1.5)+0.04] =	2.01		
Windows Type 2			2.73	x1/[1/(1.5)+0.04] =	3.86		
Windows Type 3			8.19	x1/[1/(1.5)+0.04] =	11.59		
Walls Type1	42	13.76	28.24	x 0.25 =	7.06		
Walls Type2	3.36	0	3.36	x 0.27 =	0.89		
Roof	6.5	0	6.5	x 0.15 =	0.98		
Total area of elements, m ²			51.86				

* 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) = 28.4 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 7.78 (36)

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

Total fabric heat loss (33) + (36) = 36.18 (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 =	36.76	34.84	34.84	31.33	29.24	28.27	27.34	27.34	29.75	31.33	33.03	34.84

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

(39)m =	72.94	71.02	71.02	67.51	65.42	64.45	63.52	63.52	65.93	67.51	69.21	71.02
Average = Sum(39) _{1..12} / 12 =												67.76 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.52	1.48	1.48	1.41	1.36	1.34	1.32	1.32	1.37	1.41	1.44	1.48	
Average = Sum(40) _{1...12} / 12 =													1.41

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)

Assumed occupancy, N

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

$$\text{if TFA} \leq 13.9, N = 1$$

1.6314 (42)

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

76.7853 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.46	81.39	78.32	75.25	72.18	69.11	69.11	72.18	75.25	78.32	81.39	84.46	
Total = Sum(44) _{1...12} =													921.4241

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

(45)m=	125.56	109.81	113.32	98.79	94.79	81.8	75.8	86.98	88.02	102.58	111.97	121.6	
Total = Sum(45) _{1...12} =													1211.0227

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)

(46)m=	18.83	16.47	17	14.82	14.22	12.27	11.37	13.05	13.2	15.39	16.8	18.24	(46)
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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

$$(47) \times (48) =$$

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

$$((50) \times (51) \times (52) \times (53) =$$

0 (54)

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	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
												0	(58)

Primary circuit loss (annual) from Table 3

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

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

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

(61)m=	43.04	37.46	39.91	37.11	36.78	34.08	35.22	36.78	37.11	39.91	40.14	43.04	(61)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

SAP WorkSheet: New dwelling design stage

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=	168.6	147.28	153.23	135.9	131.58	115.88	111.02	123.76	125.13	142.49	152.11	164.64	(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)
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Output from water heater

(64)m=	168.6	147.28	153.23	135.9	131.58	115.88	111.02	123.76	125.13	142.49	152.11	164.64	
Output from water heater (annual), Σ												1671.6086	(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=	52.51	45.88	47.66	42.13	40.71	35.72	34.01	38.12	38.54	44.09	47.27	51.19	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	97.88	97.88	97.88	97.88	97.88	97.88	97.88	97.88	97.88	97.88	97.88	97.88	(66)

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

(67)m=	31.66	28.12	22.87	17.31	12.94	10.93	11.81	15.34	20.6	26.15	30.52	32.54	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212	214.2	208.66	196.86	181.96	167.96	158.6	156.4	161.95	173.75	188.65	202.65	(68)
--------	-----	-------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	------

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

(69)m=	46.42	46.42	46.42	46.42	46.42	46.42	46.42	46.42	46.42	46.42	46.42	46.42	(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=	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	70.58	68.27	64.05	58.51	54.72	49.61	45.71	51.23	53.53	59.25	65.65	68.81	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	403.28	399.64	384.63	361.72	338.67	317.54	305.16	312.03	325.12	348.2	373.86	393.04	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

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

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)	
South	0.9x 0.77	x 8.19	x 47.32	x 0.63	x 0.7	= 118.45	(78)
South	0.9x 0.77	x 8.19	x 77.18	x 0.63	x 0.7	= 193.19	(78)
South	0.9x 0.77	x 8.19	x 94.25	x 0.63	x 0.7	= 235.9	(78)
South	0.9x 0.77	x 8.19	x 105.11	x 0.63	x 0.7	= 263.1	(78)
South	0.9x 0.77	x 8.19	x 108.55	x 0.63	x 0.7	= 271.7	(78)
South	0.9x 0.77	x 8.19	x 108.9	x 0.63	x 0.7	= 272.57	(78)
South	0.9x 0.77	x 8.19	x 107.14	x 0.63	x 0.7	= 268.16	(78)
South	0.9x 0.77	x 8.19	x 103.88	x 0.63	x 0.7	= 260.02	(78)

SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	8.19	x	99.99	x	0.63	x	0.7	=	250.27	(78)
South	0.9x	0.77	x	8.19	x	85.29	x	0.63	x	0.7	=	213.48	(78)
South	0.9x	0.77	x	8.19	x	56.07	x	0.63	x	0.7	=	140.34	(78)
South	0.9x	0.77	x	8.19	x	40.89	x	0.63	x	0.7	=	102.35	(78)
West	0.9x	0.77	x	1.42	x	19.87	x	0.63	x	0.7	=	17.25	(80)
West	0.9x	0.77	x	2.73	x	19.87	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.42	x	38.52	x	0.63	x	0.7	=	33.43	(80)
West	0.9x	0.77	x	2.73	x	38.52	x	0.63	x	0.7	=	32.14	(80)
West	0.9x	0.77	x	1.42	x	61.57	x	0.63	x	0.7	=	53.43	(80)
West	0.9x	0.77	x	2.73	x	61.57	x	0.63	x	0.7	=	51.37	(80)
West	0.9x	0.77	x	1.42	x	91.41	x	0.63	x	0.7	=	79.34	(80)
West	0.9x	0.77	x	2.73	x	91.41	x	0.63	x	0.7	=	76.27	(80)
West	0.9x	0.77	x	1.42	x	111.22	x	0.63	x	0.7	=	96.53	(80)
West	0.9x	0.77	x	2.73	x	111.22	x	0.63	x	0.7	=	92.79	(80)
West	0.9x	0.77	x	1.42	x	116.05	x	0.63	x	0.7	=	100.73	(80)
West	0.9x	0.77	x	2.73	x	116.05	x	0.63	x	0.7	=	96.82	(80)
West	0.9x	0.77	x	1.42	x	112.64	x	0.63	x	0.7	=	97.77	(80)
West	0.9x	0.77	x	2.73	x	112.64	x	0.63	x	0.7	=	93.98	(80)
West	0.9x	0.77	x	1.42	x	98.03	x	0.63	x	0.7	=	85.09	(80)
West	0.9x	0.77	x	2.73	x	98.03	x	0.63	x	0.7	=	81.79	(80)
West	0.9x	0.77	x	1.42	x	73.6	x	0.63	x	0.7	=	63.88	(80)
West	0.9x	0.77	x	2.73	x	73.6	x	0.63	x	0.7	=	61.41	(80)
West	0.9x	0.77	x	1.42	x	46.91	x	0.63	x	0.7	=	40.71	(80)
West	0.9x	0.77	x	2.73	x	46.91	x	0.63	x	0.7	=	39.14	(80)
West	0.9x	0.77	x	1.42	x	24.71	x	0.63	x	0.7	=	21.44	(80)
West	0.9x	0.77	x	2.73	x	24.71	x	0.63	x	0.7	=	20.61	(80)
West	0.9x	0.77	x	1.42	x	16.39	x	0.63	x	0.7	=	14.23	(80)
West	0.9x	0.77	x	2.73	x	16.39	x	0.63	x	0.7	=	13.68	(80)

Solar gains in watts, calculated for each month

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

(83)m=	152.28	258.76	340.7	418.7	461.02	470.12	459.91	426.9	375.57	293.33	182.4	130.25
--------	--------	--------	-------	-------	--------	--------	--------	-------	--------	--------	-------	--------

(83)

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

(84)m=	555.56	658.4	725.32	780.43	799.69	787.66	765.07	738.92	700.69	641.54	556.26	523.29
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(84)

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

21

(85)

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

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.98	0.95	0.91	0.84	0.69	0.51	0.34	0.35	0.6	0.84	0.96	0.98

(86)

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

(87)m=	19.79	20.06	20.36	20.67	20.89	20.98	21	21	20.96	20.72	20.19	19.83
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------

(87)

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

(88)m=	19.68	19.71	19.71	19.76	19.8	19.81	19.83	19.83	19.79	19.76	19.73	19.71
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

(88)

SAP WorkSheet: New dwelling design stage

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

(89)m=	0.97	0.94	0.89	0.79	0.62	0.42	0.24	0.25	0.5	0.79	0.94	0.97	(89)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

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

(90)m=	18.63	18.92	19.2	19.52	19.73	19.8	19.82	19.82	19.77	19.57	19.07	18.7	(90)
fLA = Living area + (4) =												0.6	(91)

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

(92)m=	19.33	19.61	19.9	20.21	20.43	20.51	20.53	20.53	20.49	20.27	19.75	19.39	(92)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.33	19.61	19.9	20.21	20.43	20.51	20.53	20.53	20.49	20.27	19.75	19.39	(93)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Utilisation factor for gains, hm:

(94)m=	0.97	0.94	0.89	0.81	0.66	0.47	0.3	0.31	0.56	0.81	0.94	0.97	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

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

(95)m=	536.68	617.65	646.03	631.67	526.93	373.13	230.06	229.93	390.86	519.28	523.85	507.01	(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=	1081.73	1037.55	930.42	777.31	571.38	381.06	230.79	230.78	407.78	639.04	882.16	1028.84	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	405.52	282.17	211.59	104.86	33.07	0	0	0	0	89.1	257.99	388.24	(98)
Total per year (kWh/year) = Sum(98) _{1...12} =												1772.54	(98)

Space heating requirement in kWh/m²/year

36.93	(99)
-------	------

Space heating:

Fraction of space heat from secondary/supplementary system

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

Fraction of space heat from main system(s)

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

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

Fraction of total heating from main system 1

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

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

Efficiency of main space heating system 1

89.9	(206)
------	-------

Efficiency of secondary/supplementary heating system, %

0	(208)
---	-------

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

Space heating requirement (calculated above)

405.52	282.17	211.59	104.86	33.07	0	0	0	0	89.1	257.99	388.24
--------	--------	--------	--------	-------	---	---	---	---	------	--------	--------

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

451.08	313.87	235.36	116.64	36.79	0	0	0	0	99.11	286.97	431.86
--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------

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

1971.67	(211)
---------	-------

Space heating fuel (secondary), kWh/month

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

(215)m=	0	0	0	0	0	0	0	0	0	0	0	(215)
---------	---	---	---	---	---	---	---	---	---	---	---	-------

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

0	(215)
---	-------

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

168.6	147.28	153.23	135.9	131.58	115.88	111.02	123.76	125.13	142.49	152.11	164.64
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Efficiency of water heater

79.8 (216)

(217)m=	86.68	86.16	85.36	83.91	81.64	79.8	79.8	79.8	79.8	83.41	85.87	86.63
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	194.51	170.93	179.5	161.97	161.16	145.21	139.12	155.09	156.8	170.84	177.14	190.04
---------	--------	--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------

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

2002.33 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

1971.67

Water heating fuel used

2002.33

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

223.63

(232)

Energy for space heating - main system 1, main system 2, secondary, water heating, pumps, fans and electric keep-hot, energy for lighting

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.1	x 0.01 = 61.1219 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	0	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	3.1	x 0.01 = 62.07 (247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 = 20.06 (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 = 25.63 (250)
Additional standing charges (Table 12)			106 (251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost

(245)...(247) + (250)...(254) =

274.8775 (255)

Energy cost deflator (Table 12)

0.47

(256)

Energy cost factor (ECF)

[(255) x (256)] ÷ [(4) + 45.0] =

1.3892

(257)

SAP rating (Section 12)

80.6211

(258)

Energy for space heating (main system 1), main system 2, secondary, water heating, pumps, fans and electric keep-hot, energy for lighting

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.198	= 390.39 (261)

SAP WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0	=	0	(263)
Water heating	(219) x	0.198	=	396.46	(264)
Space and water heating	(261) + (262) + (263) + (264) =			786.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48	(267)
Electricity for lighting	(232) x	0.517	=	115.62	(268)
Total CO2, kg/year		sum of (265)...(271) =		992.95	(272)
CO2 emissions per m²		(272) + (4) =		20.69	(273)
EI rating (section 14)				86	(274)

	Energy kWh/year	Primary factor	=	P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.02	=	2011.11	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	2042.37	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4053.48	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	653.01	(268)
'Total Primary Energy		sum of (265)...(271) =		5217.49	(272)
Primary energy kWh/m²/year		(272) + (4) =		108.7	(273)

Predicted Energy Assessment



Plot 6
3 Marine Drive West
Bognor Regis
PO21

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

Enclosed end Mid floor Flat
08 August 2013
Ondrej Gajdos
48 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.

Energy Efficiency Rating	Environmental Impact (CO ₂) Rating
Very energy efficient - lower running costs (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not energy efficient - higher running costs England & Wales EU Directive 2002/91/EC	Very environmentally friendly - lower CO₂ emissions (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not environmentally friendly - higher CO₂ emissions England & Wales EU Directive 2002/91/EC

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.

SAP WorkSheet: New dwelling design stage

Assessor Name: Ondrej Gajdos

Stroma Number:

STRO006629

Software Name: Stroma FSAP 2009

Software Version:

Version: 1.5.0.49

Address : Plot 6, 3 Marine Drive West, Bognor Regis, PO21

	Area(m ²)		Ave Height(m)		Volume(m ³)
Ground floor	48	(1a) x	2.4	(2a) =	115.2

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) 48 (4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = 115.2 (5)

	main heating	Secondary heating	other	total		m ³ per hour
Number of chimneys	0	0	0	0	x 40 =	0
Number of open flues	0	0	0	0	x 20 =	0
Number of intermittent fans				2	x 10 =	20
Number of passive vents				0	x 10 =	0
Number of flueless gas fires				0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0.17 (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 use 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 15 (17)

If based on air permeability value, then (18) = [(17) + 20] + (8), otherwise (18) = (16) 0.92 (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 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.72 (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
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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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SAP WorkSheet: New dwelling design stage

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

0.97	0.91	0.91	0.81	0.73	0.7	0.66	0.66	0.75	0.81	0.86	0.91
------	------	------	------	------	-----	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a) 0

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

(23b) 0

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

(23c) 0

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

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

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

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

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

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

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

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m = 0.97 0.92 0.92 0.82 0.77 0.74 0.72 0.72 0.78 0.82 0.87 0.92 (24d)

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

(25)m = 0.97 0.92 0.92 0.82 0.77 0.74 0.72 0.72 0.78 0.82 0.87 0.92 (25)

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.

ELEMENT	Gross area (m²)	Openings m²	Net Area A, m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			1.44	x1/[1/(1.5)+0.04] =	2.04		(27)
Windows Type 2			2.73	x1/[1/(1.5)+0.04] =	3.86		(27)
Windows Type 3			8.19	x1/[1/(1.5)+0.04] =	11.59		(27)
Windows Type 4			0.7	x1/[1/(1.5)+0.04] =	0.99		(27)
Walls Type1	42.48	14.5	27.98	x 0.25 =	6.99		(29)
Walls Type2	8.88	0	8.88	x 0.27 =	2.36		(29)
Roof	6.5	0	6.5	x 0.15 =	0.98		(30)
Total area of elements, m²			57.86				(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) = 30.85 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 8.68 (36)

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

Total fabric heat loss (33) + (36) = 39.53 (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 =	36.76	34.84	34.84	31.33	29.24	28.27	27.34	27.34	29.75	31.33	33.03	34.84

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

(39)m =	76.29	74.37	74.37	70.87	68.77	67.8	66.87	66.87	69.28	70.87	72.56	74.37
Average = Sum(39) _{1...12} / 12 =												71.11 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.59	1.55	1.55	1.48	1.43	1.41	1.39	1.39	1.44	1.48	1.51	1.55	
Average = Sum(40) _{1..12} / 12 =													1.48

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)

Assumed occupancy, N

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

$$\text{if TFA} \leq 13.9, N = 1$$

1.6314

(42)

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

76.7853

(43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.46	81.39	78.32	75.25	72.18	69.11	69.11	72.18	75.25	78.32	81.39	84.46	
Total = Sum(44) _{1..12} =													921.4241

Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)

(45)m=	125.56	109.81	113.32	98.79	94.79	81.8	75.8	86.98	88.02	102.58	111.97	121.6	
Total = Sum(45) _{1..12} =													1211.0227

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

(46)m=	18.83	16.47	17	14.82	14.22	12.27	11.37	13.05	13.2	15.39	16.8	18.24	(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

$$(47) \times (48) =$$

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

$$((50) \times (51) \times (52) \times (53) =$$

0

(54)

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	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

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

0

(58)

Primary circuit loss (annual) from Table 3

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

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

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

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

(61)m=	43.04	37.46	39.91	37.11	36.78	34.08	35.22	36.78	37.11	39.91	40.14	43.04	(61)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

SAP WorkSheet: New dwelling design stage

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

(62)m=	168.6	147.28	153.23	135.9	131.58	115.88	111.02	123.76	125.13	142.49	152.11	164.64	(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=	168.6	147.28	153.23	135.9	131.58	115.88	111.02	123.76	125.13	142.49	152.11	164.64	
Output from water heater (annual).....												1671.6086	(64)

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

(65)m=	52.51	45.88	47.66	42.13	40.71	35.72	34.01	38.12	38.54	44.09	47.27	51.19	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	97.88	97.88	97.88	97.88	97.88	97.88	97.88	97.88	97.88	97.88	97.88	97.88	(66)

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

(67)m=	31.66	28.12	22.87	17.31	12.94	10.93	11.81	15.34	20.6	26.15	30.52	32.54	(67)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(68)m=	212	214.2	208.66	196.86	181.96	167.96	158.6	156.4	161.95	173.75	188.65	202.65	(68)
--------	-----	-------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	------

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

(69)m=	46.42	46.42	46.42	46.42	46.42	46.42	46.42	46.42	46.42	46.42	46.42	46.42	(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=	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	70.58	68.27	64.05	58.51	54.72	49.61	45.71	51.23	53.53	59.25	65.65	68.81	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	403.28	399.64	384.63	361.72	338.67	317.54	305.16	312.03	325.12	348.2	373.86	393.04	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

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

Solar gains are calculated using solar flux from Table 6a and the following:

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g _L Table 6b		FF Table 6c		Gains (W)		
East	0.9x	2	x	1.44	x	19.87	x	0.63	x	0.7	=	17.49	(76)
East	0.9x	1	x	2.73	x	19.87	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	1	x	0.7	x	19.87	x	0.63	x	0.7	=	4.25	(76)
East	0.9x	2	x	1.44	x	38.52	x	0.63	x	0.7	=	33.9	(76)
East	0.9x	1	x	2.73	x	38.52	x	0.63	x	0.7	=	32.14	(76)
East	0.9x	1	x	0.7	x	38.52	x	0.63	x	0.7	=	8.24	(76)
East	0.9x	2	x	1.44	x	61.57	x	0.63	x	0.7	=	54.19	(76)
East	0.9x	1	x	2.73	x	61.57	x	0.63	x	0.7	=	51.37	(76)

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East	0.9x	1	x	0.7	x	61.57	x	0.63	x	0.7	=	13.17	(76)
East	0.9x	2	x	1.44	x	91.41	x	0.63	x	0.7	=	80.46	(76)
East	0.9x	1	x	2.73	x	91.41	x	0.63	x	0.7	=	76.27	(76)
East	0.9x	1	x	0.7	x	91.41	x	0.63	x	0.7	=	19.56	(76)
East	0.9x	2	x	1.44	x	111.22	x	0.63	x	0.7	=	97.89	(76)
East	0.9x	1	x	2.73	x	111.22	x	0.63	x	0.7	=	92.79	(76)
East	0.9x	1	x	0.7	x	111.22	x	0.63	x	0.7	=	23.79	(76)
East	0.9x	2	x	1.44	x	116.05	x	0.63	x	0.7	=	102.15	(76)
East	0.9x	1	x	2.73	x	116.05	x	0.63	x	0.7	=	96.82	(76)
East	0.9x	1	x	0.7	x	116.05	x	0.63	x	0.7	=	24.83	(76)
East	0.9x	2	x	1.44	x	112.64	x	0.63	x	0.7	=	99.14	(76)
East	0.9x	1	x	2.73	x	112.64	x	0.63	x	0.7	=	93.98	(76)
East	0.9x	1	x	0.7	x	112.64	x	0.63	x	0.7	=	24.1	(76)
East	0.9x	2	x	1.44	x	98.03	x	0.63	x	0.7	=	86.29	(76)
East	0.9x	1	x	2.73	x	98.03	x	0.63	x	0.7	=	81.79	(76)
East	0.9x	1	x	0.7	x	98.03	x	0.63	x	0.7	=	20.97	(76)
East	0.9x	2	x	1.44	x	73.6	x	0.63	x	0.7	=	64.78	(76)
East	0.9x	1	x	2.73	x	73.6	x	0.63	x	0.7	=	61.41	(76)
East	0.9x	1	x	0.7	x	73.6	x	0.63	x	0.7	=	15.75	(76)
East	0.9x	2	x	1.44	x	46.91	x	0.63	x	0.7	=	41.29	(76)
East	0.9x	1	x	2.73	x	46.91	x	0.63	x	0.7	=	39.14	(76)
East	0.9x	1	x	0.7	x	46.91	x	0.63	x	0.7	=	10.04	(76)
East	0.9x	2	x	1.44	x	24.71	x	0.63	x	0.7	=	21.75	(76)
East	0.9x	1	x	2.73	x	24.71	x	0.63	x	0.7	=	20.61	(76)
East	0.9x	1	x	0.7	x	24.71	x	0.63	x	0.7	=	5.29	(76)
East	0.9x	2	x	1.44	x	16.39	x	0.63	x	0.7	=	14.43	(76)
East	0.9x	1	x	2.73	x	16.39	x	0.63	x	0.7	=	13.68	(76)
East	0.9x	1	x	0.7	x	16.39	x	0.63	x	0.7	=	3.51	(76)
South	0.9x	0.77	x	8.19	x	47.32	x	0.63	x	0.7	=	118.45	(78)
South	0.9x	0.77	x	8.19	x	77.18	x	0.63	x	0.7	=	193.19	(78)
South	0.9x	0.77	x	8.19	x	94.25	x	0.63	x	0.7	=	235.9	(78)
South	0.9x	0.77	x	8.19	x	105.11	x	0.63	x	0.7	=	263.1	(78)
South	0.9x	0.77	x	8.19	x	108.55	x	0.63	x	0.7	=	271.7	(78)
South	0.9x	0.77	x	8.19	x	108.9	x	0.63	x	0.7	=	272.57	(78)
South	0.9x	0.77	x	8.19	x	107.14	x	0.63	x	0.7	=	268.16	(78)
South	0.9x	0.77	x	8.19	x	103.88	x	0.63	x	0.7	=	260.02	(78)
South	0.9x	0.77	x	8.19	x	99.99	x	0.63	x	0.7	=	250.27	(78)
South	0.9x	0.77	x	8.19	x	85.29	x	0.63	x	0.7	=	213.48	(78)
South	0.9x	0.77	x	8.19	x	56.07	x	0.63	x	0.7	=	140.34	(78)
South	0.9x	0.77	x	8.19	x	40.89	x	0.63	x	0.7	=	102.35	(78)

Solar gains in watts, calculated for each month

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

(83)m= 156.77 267.47 354.62 439.37 486.18 496.37 485.38 449.07 392.21 303.94 187.98 133.96 (83)

SAP WorkSheet: New dwelling design stage

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

(84)m=	560.06	667.11	739.25	801.1	824.85	813.9	790.55	761.09	717.34	652.14	561.85	527	(84)
--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	--------	-----	------

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

21 (85)

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

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	0.98	0.95	0.91	0.84	0.69	0.52	0.34	0.36	0.61	0.84	0.96	0.98	

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

(87)m=	19.71	19.99	20.3	20.63	20.88	20.97	21	21	20.95	20.68	20.12	19.76	(87)
--------	-------	-------	------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	19.63	19.65	19.65	19.71	19.74	19.76	19.77	19.77	19.73	19.71	19.68	19.65	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.97	0.94	0.89	0.79	0.62	0.42	0.24	0.25	0.51	0.79	0.94	0.97	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.52	18.81	19.11	19.44	19.67	19.75	19.77	19.77	19.71	19.5	18.97	18.59	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) = 0.6 (91)

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

(92)m=	19.24	19.52	19.83	20.16	20.4	20.49	20.51	20.51	20.46	20.21	19.66	19.29	(92)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.24	19.52	19.83	20.16	20.4	20.49	20.51	20.51	20.46	20.21	19.66	19.29	(93)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(94)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)
	0.97	0.94	0.89	0.81	0.66	0.48	0.3	0.32	0.57	0.81	0.94	0.97	

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

(95)m=	541.05	626.06	658.86	649.49	546.35	389.3	240.51	240.33	405.74	531.03	529.59	510.67	(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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Heat loss rate for mean internal temperature, Lm , W = [(39)m x ((93)m – (96)m)]

(97)m=	1124.35	1080.11	969.13	812.13	598.24	399.19	241.51	241.49	426.53	667.05	919	1070.47	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	-----	---------	------

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

(98)m=	433.98	305.12	230.84	117.09	38.6	0	0	0	0	101.2	280.37	416.49	(98)
--------	--------	--------	--------	--------	------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1,12} = 1923.7 (99)

Space heating requirement in kWh/m²/year

40.08 (99)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1 (204)

SAP WorkSheet: New dwelling design stage

Efficiency of main space heating system 1 89.9 (206)

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

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

433.98	305.12	230.84	117.09	38.6	0	0	0	0	101.2	280.37	416.49
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(211)m = $\{[(98)m \times (204)] + (210)m\} \times 100 \div (206)$ (211)

482.74	339.4	256.77	130.25	42.94	0	0	0	0	112.57	311.87	463.28
--------	-------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1..5,10..12} = 2139.82 (211)

Space heating fuel (secondary), kWh/month

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

(215)m=

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

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

Water heating

Output from water heater (calculated above)

168.6	147.28	153.23	135.9	131.58	115.88	111.02	123.76	125.13	142.49	152.11	164.64
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Efficiency of water heater

86.83	86.34	85.58	84.18	81.89	79.8	79.8	79.8	79.8	83.71	86.07	86.79
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79.8 (216)

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

194.18	170.57	179.05	161.45	160.68	145.21	139.12	155.09	156.8	170.23	176.73	189.7
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------

Total = Sum(219a)_{1..12} = 1998.82 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

2139.82

Water heating fuel used

1998.82

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

223.63

(232)

~~ENERGY FOR LIGHTING - SAP 9.90 (Table 12a) - 223.63 kWh/year (232)~~

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.1	x 0.01 = 66.3344	(240)
Space heating - main system 2	(213) x	0	x 0.01 = 0	(241)
Space heating - secondary	(215) x	0	x 0.01 = 0	(242)
Water heating cost (other fuel)	(219)	3.1	x 0.01 = 61.96	(247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 = 20.06	(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 = 25.63	(250)
Additional standing charges (Table 12)			106	(251)

SAP WorkSheet: New dwelling design stage

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)...(254) =	279.9813	(255)
Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] + [(4) + 45.0] =	1.415	(257)
SAP rating (Section 12)		80.2613	(258)

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.198	=	423.68	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Water heating	(219) x	0.198	=	395.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =			819.45	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48	(267)
Electricity for lighting	(232) x	0.517	=	115.62	(268)
Total CO2, kg/year		sum of (265)...(271) =		1025.54	(272)
CO2 emissions per m²		(272) + (4) =		21.37	(273)
EI rating (section 14)				85	(274)

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.02	=	2182.62	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	2038.8	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4221.41	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	653.01	(268)
'Total Primary Energy		sum of (265)...(271) =		5385.42	(272)
Primary energy kWh/m²/year		(272) + (4) =		112.2	(273)

Predicted Energy Assessment



Plot 7
3 Marine Drive West
Bognor Regis
PO21

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

Enclosed end Ground floor Flat
08 August 2013
Ondrej Gajdos
37 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.

Energy Efficiency Rating	Environmental Impact (CO ₂) Rating
Very energy efficient - lower running costs (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not energy efficient - higher running costs 79	Very environmentally friendly - lower CO₂ emissions (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not environmentally friendly - higher CO₂ emissions 84
England & Wales EU Directive 2002/91/EC	England & Wales EU Directive 2002/91/EC

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.

SAP WorkSheet: New dwelling design stage

Assessor Name: Ondrej Gajdos
Software Name: Stroma FSAP 2009

Stroma Number:
Software Version:

STRO006629
 Version: 1.5.0.49

Address : Plot 7, 3 Marine Drive West, Bognor Regis, PO21

Area(m²) **Ave Height(m)** **Volume(m³)**
 Ground floor (1a) x (2a) = (3a)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) (4)
 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = (5)

m³ per hour
 Number of chimneys

main heating	Secondary heating	other	total		
0	0	0	0	x 40 =	0 (6a)
0	0	0	0	x 20 =	0 (6b)
			2	x 10 =	20 (7a)
			0	x 10 =	0 (7b)
			0	x 40 =	0 (7c)

Air changes per hour
 Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = + (5) = (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)

Additional infiltration

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

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

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration

Infiltration rate

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

If based on air permeability value, then (18) = [(17) + 20] + (8), otherwise (18) = (16)

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

Shelter factor

Infiltration rate incorporating shelter factor

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

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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SAP WorkSheet: New dwelling design stage

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

1.02	0.96	0.96	0.85	0.77	0.74	0.7	0.7	0.79	0.85	0.91	0.96
------	------	------	------	------	------	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

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

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

0	(23a)
0	(23b)
0	(23c)

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

(24a)m=	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	(24b)
---------	---	---	---	---	---	---	---	---	---	---	---	-------

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

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	(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=	1.02	0.96	0.96	0.86	0.8	0.77	0.74	0.74	0.81	0.86	0.91	0.96	(24d)
---------	------	------	------	------	-----	------	------	------	------	------	------	------	-------

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

(25)m=	1.02	0.96	0.96	0.86	0.8	0.77	0.74	0.74	0.81	0.86	0.91	0.96	(25)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

U-value W/m²K

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			2.52	1.5	3.78		
Windows Type 1			1.42	1/[1/(1.5) + 0.04]	2.01		
Windows Type 2			0.95	1/[1/(1.5) + 0.04]	1.34		
Windows Type 3			1.22	1/[1/(1.5) + 0.04]	1.73		
Windows Type 4			1.79	1/[1/(1.5) + 0.04]	2.53		
Floor			5.6	0.2	1.12		
Walls Type1	37.2	7.9	29.3	0.25	7.33		
Walls Type2	8.4	0	8.4	0.27	2.24		
Total area of elements, m²			51.2				

* 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) = 22.07 (33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) = 0 (34)

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

Indicative Value: Medium 250 (35)

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

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

7.68 (36)

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

(33) + (36) = 29.75 (37)

Total fabric heat loss

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

Ventilation heat loss calculated monthly

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.9	28.26	28.26	25.24	23.45	22.61	21.81	21.81	23.88	25.24	26.7	28.26	(38)

Heat transfer coefficient, W/K

(39)m=	59.65	58.01	58.01	55	53.2	52.36	51.57	51.57	53.63	55	56.46	58.01	(39)
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Average = Sum(39)...12 = 55.24 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

(40)m =

1.61	1.57	1.57	1.49	1.44	1.42	1.39	1.39	1.45	1.49	1.53	1.57
------	------	------	------	------	------	------	------	------	------	------	------

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

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

1.49

(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)

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

	1.3291	(42)
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Annual average hot water usage in litres per day Vd, average = (25 x N) + 36

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

	69.2271	(43)
--	---------	------

not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m =	76.15	73.38	70.61	67.84	65.07	62.3	62.3	65.07	67.84	70.61	73.38	76.15	
Total = Sum(44) _{1..12} =												830.7253	(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 =	113.2	99	102.16	89.07	85.46	73.75	68.34	78.42	79.36	92.48	100.95	109.63		
Total = Sum(45) _{1..12} =													1091.8178	(45)

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

(46)m =	16.98	14.85	15.32	13.36	12.82	11.06	10.25	11.76	11.9	13.87	15.14	16.44	(46)
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Water storage loss:

	0	(47)
--	---	------

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

	0	(48)
--	---	------

Temperature factor from Table 2b

	0	(49)
--	---	------

Energy lost from water storage, kWh/year

(47) x (48) =

	0	(50)
--	---	------

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

	0	(50)
--	---	------

Cylinder volume (litres) including any solar storage within same

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

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

	0	(55)
--	---	------

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

	0	(58)
--	---	------

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

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

(59)m =	0	0	0	0	0	0	0	0	0	0	0	0	(59)
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Combi loss calculated for each month (61)m = (60) + 365 x (41)m

(61)m =	38.81	33.78	35.98	33.46	33.16	30.73	31.75	33.16	33.46	35.98	36.19	38.81	(61)
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SAP WorkSheet: New dwelling design stage

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

(62)m=	152	132.78	138.15	122.52	118.62	104.47	100.09	111.58	112.81	128.46	137.14	148.43	(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=	152	132.78	138.15	122.52	118.62	104.47	100.09	111.58	112.81	128.46	137.14	148.43	
Output from water heater (annual) Σ_{12}												1507.0666	(64)

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

(65)m=	47.34	41.36	42.96	37.98	36.71	32.2	30.66	34.36	34.75	39.75	42.61	46.15	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	79.75	79.75	79.75	79.75	79.75	79.75	79.75	79.75	79.75	79.75	79.75	79.75	(66)

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

(67)m=	26.1	23.18	18.85	14.27	10.67	9.01	9.73	12.65	16.98	21.56	25.16	26.82	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	170.25	172.02	167.57	158.09	146.13	134.88	127.37	125.6	130.05	139.53	151.5	162.74	(68)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	--------	------

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

(69)m=	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	(69)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	(71)
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Water heating gains (Table 5)

(72)m=	63.63	61.55	57.75	52.75	49.34	44.73	41.21	46.19	48.26	53.42	59.18	62.03	(72)
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Total internal gains =

(73)m=	340.86	337.64	325.05	306	287.02	269.5	259.2	265.33	276.18	295.4	316.73	332.48	(73)
--------	--------	--------	--------	-----	--------	-------	-------	--------	--------	-------	--------	--------	------

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)	
North	0.9x 0.77	x 1.79	x 10.73	x 0.63	x 0.7	= 5.87	(74)
North	0.9x 0.77	x 1.79	x 20.36	x 0.63	x 0.7	= 11.14	(74)
North	0.9x 0.77	x 1.79	x 33.31	x 0.63	x 0.7	= 18.22	(74)
North	0.9x 0.77	x 1.79	x 54.64	x 0.63	x 0.7	= 29.89	(74)
North	0.9x 0.77	x 1.79	x 75.22	x 0.63	x 0.7	= 41.15	(74)
North	0.9x 0.77	x 1.79	x 84.09	x 0.63	x 0.7	= 46	(74)
North	0.9x 0.77	x 1.79	x 79.12	x 0.63	x 0.7	= 43.28	(74)
North	0.9x 0.77	x 1.79	x 61.56	x 0.63	x 0.7	= 33.68	(74)

SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.79	x	41.09	x	0.63	x	0.7	=	22.48	(74)
North	0.9x	0.77	x	1.79	x	24.81	x	0.63	x	0.7	=	13.57	(74)
North	0.9x	0.77	x	1.79	x	13.22	x	0.63	x	0.7	=	7.23	(74)
North	0.9x	0.77	x	1.79	x	8.94	x	0.63	x	0.7	=	4.89	(74)
West	0.9x	0.77	x	1.42	x	19.87	x	0.63	x	0.7	=	8.62	(80)
West	0.9x	0.77	x	0.95	x	19.87	x	0.63	x	0.7	=	5.77	(80)
West	0.9x	0.77	x	1.22	x	19.87	x	0.63	x	0.7	=	7.41	(80)
West	0.9x	0.77	x	1.42	x	38.52	x	0.63	x	0.7	=	16.72	(80)
West	0.9x	0.77	x	0.95	x	38.52	x	0.63	x	0.7	=	11.18	(80)
West	0.9x	0.77	x	1.22	x	38.52	x	0.63	x	0.7	=	14.36	(80)
West	0.9x	0.77	x	1.42	x	61.57	x	0.63	x	0.7	=	26.72	(80)
West	0.9x	0.77	x	0.95	x	61.57	x	0.63	x	0.7	=	17.87	(80)
West	0.9x	0.77	x	1.22	x	61.57	x	0.63	x	0.7	=	22.95	(80)
West	0.9x	0.77	x	1.42	x	91.41	x	0.63	x	0.7	=	39.67	(80)
West	0.9x	0.77	x	0.95	x	91.41	x	0.63	x	0.7	=	26.54	(80)
West	0.9x	0.77	x	1.22	x	91.41	x	0.63	x	0.7	=	34.08	(80)
West	0.9x	0.77	x	1.42	x	111.22	x	0.63	x	0.7	=	48.27	(80)
West	0.9x	0.77	x	0.95	x	111.22	x	0.63	x	0.7	=	32.29	(80)
West	0.9x	0.77	x	1.22	x	111.22	x	0.63	x	0.7	=	41.47	(80)
West	0.9x	0.77	x	1.42	x	116.05	x	0.63	x	0.7	=	50.36	(80)
West	0.9x	0.77	x	0.95	x	116.05	x	0.63	x	0.7	=	33.69	(80)
West	0.9x	0.77	x	1.22	x	116.05	x	0.63	x	0.7	=	43.27	(80)
West	0.9x	0.77	x	1.42	x	112.64	x	0.63	x	0.7	=	48.88	(80)
West	0.9x	0.77	x	0.95	x	112.64	x	0.63	x	0.7	=	32.7	(80)
West	0.9x	0.77	x	1.22	x	112.64	x	0.63	x	0.7	=	42	(80)
West	0.9x	0.77	x	1.42	x	98.03	x	0.63	x	0.7	=	42.54	(80)
West	0.9x	0.77	x	0.95	x	98.03	x	0.63	x	0.7	=	28.46	(80)
West	0.9x	0.77	x	1.22	x	98.03	x	0.63	x	0.7	=	36.55	(80)
West	0.9x	0.77	x	1.42	x	73.6	x	0.63	x	0.7	=	31.94	(80)
West	0.9x	0.77	x	0.95	x	73.6	x	0.63	x	0.7	=	21.37	(80)
West	0.9x	0.77	x	1.22	x	73.6	x	0.63	x	0.7	=	27.44	(80)
West	0.9x	0.77	x	1.42	x	46.91	x	0.63	x	0.7	=	20.36	(80)
West	0.9x	0.77	x	0.95	x	46.91	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.22	x	46.91	x	0.63	x	0.7	=	17.49	(80)
West	0.9x	0.77	x	1.42	x	24.71	x	0.63	x	0.7	=	10.72	(80)
West	0.9x	0.77	x	0.95	x	24.71	x	0.63	x	0.7	=	7.17	(80)
West	0.9x	0.77	x	1.22	x	24.71	x	0.63	x	0.7	=	9.21	(80)
West	0.9x	0.77	x	1.42	x	16.39	x	0.63	x	0.7	=	7.11	(80)
West	0.9x	0.77	x	0.95	x	16.39	x	0.63	x	0.7	=	4.76	(80)
West	0.9x	0.77	x	1.22	x	16.39	x	0.63	x	0.7	=	6.11	(80)

Solar gains in watts, calculated for each month

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

(83)m=	27.67	53.4	85.77	130.18	163.17	173.33	166.87	141.24	103.23	65.04	34.34	22.88
--------	-------	------	-------	--------	--------	--------	--------	--------	--------	-------	-------	-------

(83)

SAP WorkSheet: New dwelling design stage

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

(84)m=	368.54	391.03	410.82	436.18	450.19	442.83	426.06	406.56	379.41	360.44	351.07	355.36	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.93	0.84	0.68	0.48	0.5	0.78	0.94	0.98	0.99	(86)

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

(87)m=	19.55	19.72	19.99	20.36	20.72	20.92	20.99	20.98	20.85	20.46	19.94	19.62	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.61	19.64	19.64	19.7	19.74	19.76	19.77	19.77	19.73	19.7	19.67	19.64	(88)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(89)m=	0.98	0.97	0.96	0.91	0.79	0.58	0.35	0.36	0.69	0.91	0.97	0.98	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.35	18.54	18.81	19.2	19.56	19.72	19.77	19.77	19.66	19.31	18.78	18.45	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area + (4) = 0.54 (91)

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

(92)m=	18.99	19.17	19.45	19.83	20.19	20.37	20.43	20.43	20.3	19.93	19.41	19.08	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(93)m=	18.99	19.17	19.45	19.83	20.19	20.37	20.43	20.43	20.3	19.93	19.41	19.08	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.95	0.91	0.81	0.63	0.42	0.44	0.74	0.91	0.97	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	360.62	379.89	391.47	398.39	364.53	280.52	179.24	178.68	279.28	328.64	339.93	347.93	(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=	864.65	822.24	733.83	611.99	451.64	302.16	181.9	181.83	321.96	502.39	700.48	822.78	(97)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

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

(98)m=	374.99	297.26	254.72	153.8	64.81	0	0	0	0	129.27	259.59	353.28	(98)
--------	--------	--------	--------	-------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)1...12 = 1887.72 (99)

Space heating requirement in kWh/m²/year

51.02 (99)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1 (204)

SAP WorkSheet: New dwelling design stage

Efficiency of main space heating system 1 89.9 (206)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
374.99	297.26	254.72	153.8	64.81	0	0	0	0	129.27	259.59	353.28	

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

417.12	330.65	283.33	171.07	72.09	0	0	0	0	143.79	288.76	392.97	
Total (kWh/year) = Sum(211) _{1..12} =												2099.8 (211)

Space heating fuel (secondary), kWh/month

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

(215)m = (215)

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

Water heating

Output from water heater (calculated above)

152	132.78	138.15	122.52	118.62	104.47	100.09	111.58	112.81	128.46	137.14	148.43	
79.8 (216)												

Efficiency of water heater (217)

(217)m = (217)

86.73	86.52	86.07	85.12	83.1	79.8	79.8	79.8	79.8	84.57	86.13	86.66	
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Fuel for water heating, kWh/month

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

(219)m = (219)

175.25	153.47	160.51	143.94	142.75	130.92	125.42	139.82	141.37	151.91	159.22	171.29	
Total = Sum(219a) _{1..12} =												1795.88 (219)

Annual totals

Space heating fuel used, main system 1 2099.8 kWh/year

Water heating fuel used 1795.88 kWh/year

Electricity for pumps, fans and electric keep-hot

central heating pump: 130 (230c)

boiler with a fan-assisted flue 45 (230e)

sum of (230a)...(230g) = 175 (231)

Total electricity for the above, kWh/year 184.36 (232)

Electricity for lighting

[Faint text: The following table shows the fuel costs for the different heating systems. The fuel costs are calculated using the fuel prices from Table 12a and the fuel consumption from the previous tables.]

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.1	x 0.01 =	65.0937 (240)
Space heating - main system 2	(213) x	0	x 0.01 =	0 (241)
Space heating - secondary	(215) x	0	x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.1	x 0.01 =	55.67 (247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 =	20.06 (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 =	21.13 (250)
Additional standing charges (Table 12)				106 (251)

SAP WorkSheet: New dwelling design stage

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost

$$(245) \dots (247) + (250) \dots (254) =$$

267.9483 (255)

Energy cost deflator (Table 12)

0.47 (256)

Energy cost factor (ECF)

$$[(255) \times (256)] \div [(4) + 45.0] =$$

1.5358 (257)

SAP rating (Section 12)

78.5756 (258)

	Energy kWh/year	Emission factor kg CO2/kWh	=	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.198	=	415.76	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Water heating	(219) x	0.198	=	355.58	(264)
Space and water heating	(261) + (262) + (263) + (264) =			771.34	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48	(267)
Electricity for lighting	(232) x	0.517	=	95.31	(268)
Total CO2, kg/year		sum of (265) ... (271) =		957.13	(272)
CO2 emissions per m ²		(272) + (4) =		25.87	(273)
El rating (section 14)				84	(274)

	Energy kWh/year	Primary factor	=	P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.02	=	2141.79	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	1831.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			3973.58	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	538.33	(268)
'Total Primary Energy		sum of (265) ... (271) =		5022.91	(272)
Primary energy kWh/m ² /year		(272) + (4) =		135.75	(273)

Predicted Energy Assessment

SAP

Plot 8
3 Marine Drive West
Bognor Regis
PO21

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

Enclosed end Ground floor Flat
08 August 2013
Ondrej Gajdos
31 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.

Energy Efficiency Rating	Environmental Impact (CO ₂) Rating
Very energy efficient - lower running costs (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not energy efficient - higher running costs 78	Very environmentally friendly - lower CO₂ emissions (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E 85 F G Not environmentally friendly - higher CO₂ emissions
England & Wales EU Directive 2002/91/EC	England & Wales EU Directive 2002/91/EC

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.

SAP WorkSheet: New dwelling design stage

Assessor Name: Ondrej Gajdos
Software Name: Stroma FSAP 2009

Stroma Number:
Software Version:

STRO006629
 Version: 1.5.0.49

Address : Plot 8, 3 Marine Drive West, Bognor Regis, PO21

	Area(m ²)	Ave Height(m)	Volume(m ³)
Ground floor	31 (1a)	2.4 (2a)	74.4 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	31 (4)		
Dwelling volume			74.4 (5)

	main heating	Secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0.27 (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)

Additional infiltration

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

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

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration

Infiltration rate

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

If based on air permeability value, then (18) = [(17) + 20] + (8), otherwise (18) = (16)

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

Shelter factor

Infiltration rate incorporating shelter factor

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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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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SAP WorkSheet: New dwelling design stage

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

1.07	1.01	1.01	0.89	0.81	0.77	0.73	0.73	0.83	0.89	0.95	1.01
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) + 100]

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

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

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

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

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

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

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m = 1.07 1.01 1.01 0.89 0.83 0.8 0.77 0.77 0.84 0.89 0.95 1.01 (24d)

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

(25)m = 1.07 1.01 1.01 0.89 0.83 0.8 0.77 0.77 0.84 0.89 0.95 1.01 (25)

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			2.52	1.5	3.78		(26)
Windows Type 1			1.44	$1/[1/(1.5) + 0.04]$	2.04		(27)
Windows Type 2			1.79	$1/[1/(1.5) + 0.04]$	2.53		(27)
Floor			5.6	0.2	1.12		(28)
Walls Type1	30.96	7.19	23.77	0.25	5.94		(29)
Walls Type2	8.64	0	8.64	0.27	2.3		(29)
Total area of elements, m²			45.2				(31)

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

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

Fabric heat loss, W/K = S (A x U)

(26)...(30) + (32) = 19.75 (33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm + TFA) in kJ/m²K

Indicative Value: Medium 250 (35)

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

Thermal bridges : $\dot{S}$ (L x Y) calculated using Appendix K

6.78 (36)

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

Total fabric heat loss

(33) + (36) = 26.53 (37)

Ventilation heat loss calculated monthly

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m =	26.17	24.72	24.72	21.96	20.32	19.55	18.82	18.82	20.71	21.96	23.3	24.72

Heat transfer coefficient, W/K

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

(39)m =	52.7	51.25	51.25	48.49	46.85	46.08	45.36	45.36	47.24	48.49	49.83	51.25
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Average = Sum(39) / 12 = 48.68 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.7	1.65	1.65	1.56	1.51	1.49	1.46	1.46	1.52	1.56	1.61	1.65	
	Average = Sum(40) _{1...12} / 12 =												1.57

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)

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

1.193

(42)

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

65.8245

(43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	72.41	69.77	67.14	64.51	61.88	59.24	59.24	61.88	64.51	67.14	69.77	72.41	
	Total = Sum(44) _{1...12} =												789.8938

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=	107.63	94.14	97.14	84.69	81.26	70.12	64.98	74.56	75.46	87.94	95.99	104.24	
	Total = Sum(45) _{1...12} =												1038.1531

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

(46)m=	16.15	14.12	14.57	12.7	12.19	10.52	9.75	11.18	11.32	13.19	14.4	15.64	(46)
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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

$$(47) \times (48) =$$

0

(49)

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

0

(50)

Cylinder volume (litres) including any solar storage within same

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

$$((50) \times (51) \times (52) \times (53) =$$

0

(54)

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	0	(56)
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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] + (50), else (57)m = (56)m where (H11) is from Appendix H

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

(58)

Primary circuit loss (annual) from Table 3

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

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

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

(61)m=	36.9	32.12	34.21	31.81	31.53	29.22	30.19	31.53	31.81	34.21	34.41	36.9	(61)
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SAP WorkSheet: New dwelling design stage

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

(62)m=	144.53	126.25	131.36	116.5	112.79	99.34	95.17	106.1	107.27	122.15	130.4	141.14	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
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Output from water heater

(64)m=	144.53	126.25	131.36	116.5	112.79	99.34	95.17	106.1	107.27	122.15	130.4	141.14	
Output from water heater (annual).....												1432.9917	(64)

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

(65)m=	45.01	39.33	40.85	36.11	34.9	30.62	29.15	32.68	33.04	37.79	40.52	43.88	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	71.58	71.58	71.58	71.58	71.58	71.58	71.58	71.58	71.58	71.58	71.58	71.58	(66)

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

(67)m=	22.6	20.07	16.32	12.36	9.24	7.8	8.43	10.95	14.7	18.67	21.79	23.23	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.85	150.4	146.5	138.22	127.76	117.93	111.36	109.81	113.71	121.99	132.45	142.28	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	43.35	43.35	43.35	43.35	43.35	43.35	43.35	43.35	43.35	43.35	43.35	43.35	(69)
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Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-47.72	-47.72	-47.72	-47.72	-47.72	-47.72	-47.72	-47.72	-47.72	-47.72	-47.72	-47.72	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	60.5	58.53	54.91	50.16	46.91	42.53	39.18	43.92	45.89	50.8	56.28	58.98	(72)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(73)m=	309.16	306.2	294.95	277.94	261.12	245.46	236.18	241.9	251.51	268.67	287.73	301.7	(73)
--------	--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	------

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

Solar gains are calculated using solar flux from Table 6a and the following:

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g _s Table 6b		FF Table 6c		Gains (W)		
North	0.9x	0.77	x	1.79	x	10.73	x	0.63	x	0.7	=	5.87	(74)
North	0.9x	0.77	x	1.79	x	20.36	x	0.63	x	0.7	=	11.14	(74)
North	0.9x	0.77	x	1.79	x	33.31	x	0.63	x	0.7	=	18.22	(74)
North	0.9x	0.77	x	1.79	x	54.64	x	0.63	x	0.7	=	29.89	(74)
North	0.9x	0.77	x	1.79	x	75.22	x	0.63	x	0.7	=	41.15	(74)
North	0.9x	0.77	x	1.79	x	84.09	x	0.63	x	0.7	=	46	(74)
North	0.9x	0.77	x	1.79	x	79.12	x	0.63	x	0.7	=	43.28	(74)
North	0.9x	0.77	x	1.79	x	61.56	x	0.63	x	0.7	=	33.68	(74)

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North	0.9x	0.77	x	1.79	x	41.09	x	0.63	x	0.7	=	22.48	(74)
North	0.9x	0.77	x	1.79	x	24.81	x	0.63	x	0.7	=	13.57	(74)
North	0.9x	0.77	x	1.79	x	13.22	x	0.63	x	0.7	=	7.23	(74)
North	0.9x	0.77	x	1.79	x	8.94	x	0.63	x	0.7	=	4.89	(74)
East	0.9x	2	x	1.44	x	19.87	x	0.63	x	0.7	=	17.49	(76)
East	0.9x	2	x	1.44	x	38.52	x	0.63	x	0.7	=	33.9	(76)
East	0.9x	2	x	1.44	x	61.57	x	0.63	x	0.7	=	54.19	(76)
East	0.9x	2	x	1.44	x	91.41	x	0.63	x	0.7	=	80.46	(76)
East	0.9x	2	x	1.44	x	111.22	x	0.63	x	0.7	=	97.89	(76)
East	0.9x	2	x	1.44	x	116.05	x	0.63	x	0.7	=	102.15	(76)
East	0.9x	2	x	1.44	x	112.64	x	0.63	x	0.7	=	99.14	(76)
East	0.9x	2	x	1.44	x	98.03	x	0.63	x	0.7	=	86.29	(76)
East	0.9x	2	x	1.44	x	73.6	x	0.63	x	0.7	=	64.78	(76)
East	0.9x	2	x	1.44	x	46.91	x	0.63	x	0.7	=	41.29	(76)
East	0.9x	2	x	1.44	x	24.71	x	0.63	x	0.7	=	21.75	(76)
East	0.9x	2	x	1.44	x	16.39	x	0.63	x	0.7	=	14.43	(76)

Solar gains in watts, calculated for each month

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

(83)m=	23.36	45.04	72.41	110.35	139.04	148.15	142.43	119.97	87.26	54.86	28.98	19.32	(83)
--------	-------	-------	-------	--------	--------	--------	--------	--------	-------	-------	-------	-------	------

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

(84)m=	332.52	351.24	367.36	388.29	400.16	393.61	378.61	361.86	338.77	323.53	316.7	321.03	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

21 (85)

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

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	0.98	0.98	0.96	0.93	0.84	0.68	0.48	0.5	0.77	0.93	0.97	0.98	

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

(87)m=	19.51	19.68	19.96	20.33	20.71	20.92	20.99	20.98	20.85	20.45	19.91	19.59	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.55	19.58	19.58	19.64	19.68	19.7	19.72	19.72	19.67	19.64	19.61	19.58	(88)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.98	0.97	0.95	0.9	0.77	0.57	0.34	0.35	0.67	0.89	0.96	0.98	(89)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(90)m=	18.26	18.45	18.73	19.13	19.5	19.67	19.72	19.72	19.6	19.25	18.71	18.36	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	------

fLA = Living area + (4) =

0.48 (91)

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

(92)m=	18.86	19.04	19.32	19.72	20.09	20.27	20.33	20.33	20.2	19.83	19.29	18.95	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(93)m=	18.86	19.04	19.32	19.72	20.09	20.27	20.33	20.33	20.2	19.83	19.29	18.95	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

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

(94)m=	0.97	0.97	0.94	0.9	0.8	0.62	0.4	0.42	0.72	0.9	0.96	0.97	(94)
--------	------	------	------	-----	-----	------	-----	------	------	-----	------	------	------

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

(95)m=	323.61	339.08	347.13	350.53	318.16	242.77	153.31	152.86	242.89	290.74	304.37	312.6	(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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Heat loss rate for mean internal temperature, Lm, W = [(39)m x ((93)m - (96)m)]

(97)m=	756.83	719.7	641.86	534.15	392.89	261.35	155.59	155.53	278.86	437.94	612.42	720.24	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m

(98)m=	322.31	255.78	219.28	132.2	55.6	0	0	0	0	109.52	221.79	303.29	(98)
--------	--------	--------	--------	-------	------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...12} = 1619.77

52.25 (99)

Space heating requirement in kWh/m²/year

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 - (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) x [1 - (203)] =

1 (204)

Efficiency of main space heating system 1

89.9 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

322.31	255.78	219.28	132.2	55.6	0	0	0	0	109.52	221.79	303.29
--------	--------	--------	-------	------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] + (210)m} x 100 + (206)

358.52	284.51	243.92	147.06	61.85	0	0	0	0	121.82	246.71	337.36
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1...12} = 1801.74 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214)m} x 100 + (208)

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

Water heating

Output from water heater (calculated above)

144.53	126.25	131.36	116.5	112.79	99.34	95.17	106.1	107.27	122.15	130.4	141.14
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79.8 (216)

Efficiency of water heater

(217)m=	86.51	86.29	85.83	84.87	82.87	79.8	79.8	79.8	79.8	84.28	85.88	86.43	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 + (217)m

(219)m=	167.07	146.31	153.04	137.27	136.1	124.48	119.26	132.95	134.42	144.94	151.85	163.3	(219)
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Total = Sum(219a)_{1...12} =

1711 (219)

kWh/year

kWh/year

Annual totals

Space heating fuel used, main system 1

1801.74

Water heating fuel used

1711

Electricity for pumps, fans and electric keep-hot

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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 159.64 (232)

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.1	x 0.01 = 55.854 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	0	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	3.1	x 0.01 = 53.04 (247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 = 20.06 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a)	(232)	11.46	x 0.01 = 18.29 (250)
Energy for lighting			106 (251)
Additional standing charges (Table 12)			

Appendix Q items: repeat lines (253) and (254) as needed
 Total energy cost (245)...(247) + (250)...(254) = 253.2445 (255)

Energy cost deflator (Table 12) 0.47 (256)
 Energy cost factor (ECF) [(255) x (256)] + [(4) + 45.0] = 1.5661 (257)

SAP rating (Section 12) 78.1527 (258)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.198	= 356.74 (261)
Space heating (secondary)	(215) x	0	= 0 (263)
Water heating	(219) x	0.198	= 338.78 (264)
Space and water heating	(261) + (262) + (263) + (264) =		695.52 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	= 90.48 (267)
Electricity for lighting	(232) x	0.517	= 82.53 (268)
Total CO2, kg/year		sum of (265)...(271) =	868.53 (272)
CO2 emissions per m²		(272) + (4) =	28.02 (273)
El rating (section 14)			85 (274)

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.02	= 1837.78 (261)

SAP WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	1745.22	(264)
Space and water heating	(261) + (262) + (263) + (264) =			3583	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	466.14	(268)
'Total Primary Energy		sum of (265)...(271) =		4560.14	(272)
Primary energy kWh/m ² /year		(272) + (4) =		147.1	(273)

Predicted Energy Assessment



Plot 9
3 Marine Drive West
Bognor Regis
PO21

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

Enclosed end Top floor Flat
08 August 2013
Ondrej Gajdos
41 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.

Energy Efficiency Rating	Environmental Impact (CO ₂) Rating
Very energy efficient - lower running costs (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not energy efficient - higher running costs 79 England & Wales EU Directive 2002/91/EC	Very environmentally friendly - lower CO₂ emissions (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not environmentally friendly - higher CO₂ emissions 84 England & Wales EU Directive 2002/91/EC

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.

SAP WorkSheet: New dwelling design stage

Assessor Name: Ondrej Gajdos
Software Name: Stroma FSAP 2009

Stroma Number:
Software Version:

STRO006629
 Version: 1.5.0.49

Address : Plot 9, 3 Marine Drive West, Bognor Regis, PO21

	Area(m ²)	Ave Height(m)	Volume(m ³)
Ground floor	41 (1a)	2.4 (2a)	98.4 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	41 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	98.4 (5)

	main heating	Secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour
 Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0.2 (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)

Additional infiltration

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

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

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration

$$0.25 - [0.2 \times (14) + 100] =$$

Infiltration rate

$$(8) + (10) + (11) + (12) + (13) + (15) =$$

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

If based on air permeability value, then (18) = [(17) + 20] + (8), otherwise (18) = (16)

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

Shelter factor

$$(20) = 1 - [0.075 \times (19)] =$$

Infiltration rate incorporating shelter factor

$$(21) = (18) \times (20) =$$

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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SAP WorkSheet: New dwelling design stage

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

1	0.94	0.94	0.83	0.76	0.72	0.68	0.68	0.78	0.83	0.89	0.94
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

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

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

0	(23a)
0	(23b)
0	(23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	(24a)
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	(24b)
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	(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)m x 0.5]

(24d)m=	1	0.94	0.94	0.85	0.79	0.76	0.73	0.73	0.8	0.85	0.89	0.94	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	1	0.94	0.94	0.85	0.79	0.76	0.73	0.73	0.8	0.85	0.89	0.94	(25)
--------	---	------	------	------	------	------	------	------	-----	------	------	------	------

ELEMENT	Gross area (m²)	Openings m²	Net Area A, m²	U-value W/m²K	A X U (W/K)	k-value kJ/m².K	A X k kJ/K	
Windows Type 1			1.42	x 1/[1/(1.5) + 0.04] =	2.01			(27)
Windows Type 2			7.69	x 1/[1/(1.5) + 0.04] =	10.88			(27)
Walls Type1	9.38	7.69	1.68	x 0.25 =	0.42			(29)
Walls Type2	3.36	0	3.36	x 0.27 =	0.89			(29)
Walls Type3	26	2.84	23.16	x 0.25 =	5.79			(29)
Roof Type1	16	0	16	x 0.15 =	2.4			(30)
Roof Type2	2.5	0	2.5	x 0.15 =	0.38			(30)
Roof Type3	22.8	0	22.8	x 0.15 =	3.42			(30)
Total area of elements, m²			80.035					(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) = 28.2 (33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm + TFA) in kJ/m²K

Indicative Value: Medium 250 (35)

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

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

12.01 (36)

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

Total fabric heat loss

(33) + (36) = 40.21 (37)

Ventilation heat loss calculated monthly

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

(38)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
	32.39	30.64	30.64	27.45	25.55	24.66	23.82	23.82	26.01	27.45	29	30.64	

Heat transfer coefficient, W/K

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

(39)m=	72.59	70.85	70.85	67.66	65.75	64.87	64.02	64.02	66.21	67.66	69.2	70.85	(39)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

Average = Sum(39) 1...12 /12=

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SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.77	1.73	1.73	1.65	1.6	1.58	1.56	1.56	1.61	1.65	1.69	1.73		
	Average = Sum(40) _{1...12} / 12 =												1.66	(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)

Assumed occupancy, N

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

$$\text{if TFA} \leq 13.9, N = 1$$

1.4332 (42)

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

71.829 (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)

(44)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	79.01	76.14	73.27	70.39	67.52	64.65	64.65	67.52	70.39	73.27	76.14	79.01		
	Total = Sum(44) _{1...12} =												861.9484	(44)

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

(45)m=	117.45	102.72	106	92.42	88.68	76.52	70.91	81.37	82.34	95.96	104.75	113.75		
	Total = Sum(45) _{1...12} =												1132.854	(45)

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

(46)m=	17.62	15.41	15.9	13.86	13.3	11.48	10.64	12.2	12.35	14.39	15.71	17.06		(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

$$(47) \times (48) =$$

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

$$((50) \times (51) \times (52) \times (53) =$$

0 (54)

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	0		(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	--	------

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

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

0 (58)

Primary circuit loss (annual) from Table 3

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

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

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

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

(61)m=	40.26	35.04	37.34	34.71	34.41	31.88	32.94	34.41	34.71	37.34	37.55	40.26		(61)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

SAP WorkSheet: New dwelling design stage

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

(62)m=	157.72	137.77	143.34	127.13	123.08	108.4	103.85	115.77	117.05	133.29	142.29	154.01	(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=	157.72	137.77	143.34	127.13	123.08	108.4	103.85	115.77	117.05	133.29	142.29	154.01	
Output from water heater (annual) 1...12												1563.7102	(64)

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

(65)m=	49.12	42.92	44.58	39.41	38.09	33.41	31.81	35.66	36.06	41.24	44.21	47.89	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

Metabolic gains (Table 5), Watts

(66)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	(66)

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

(67)m=	27.65	24.56	19.97	15.12	11.3	9.54	10.31	13.4	17.99	22.84	26.66	28.42	(67)
--------	-------	-------	-------	-------	------	------	-------	------	-------	-------	-------	-------	------

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

(68)m=	185.16	187.08	182.24	171.93	158.92	146.69	138.52	136.6	141.44	151.75	164.76	176.99	(68)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	(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=	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	66.02	63.86	59.92	54.73	51.19	46.41	42.76	47.93	50.08	55.43	61.41	64.36	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	362.52	359.2	345.82	325.48	305.11	286.33	275.28	281.62	293.2	313.71	336.52	353.47	(73)
--------	--------	-------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

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 _s Table 6b	FF Table 6c	Gains (W)	
South	0.9x 0.77	x 7.69	x 47.32	x 0.63	x 0.7	= 111.22	(78)
South	0.9x 0.77	x 7.69	x 77.18	x 0.63	x 0.7	= 181.39	(78)
South	0.9x 0.77	x 7.69	x 94.25	x 0.63	x 0.7	= 221.49	(78)
South	0.9x 0.77	x 7.69	x 105.11	x 0.63	x 0.7	= 247.04	(78)
South	0.9x 0.77	x 7.69	x 108.55	x 0.63	x 0.7	= 255.11	(78)
South	0.9x 0.77	x 7.69	x 108.9	x 0.63	x 0.7	= 255.93	(78)
South	0.9x 0.77	x 7.69	x 107.14	x 0.63	x 0.7	= 251.79	(78)
South	0.9x 0.77	x 7.69	x 103.88	x 0.63	x 0.7	= 244.14	(78)

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South	0.9x	0.77	x	7.69	x	99.99	x	0.63	x	0.7	=	235	(78)
South	0.9x	0.77	x	7.69	x	85.29	x	0.63	x	0.7	=	200.45	(78)
South	0.9x	0.77	x	7.69	x	56.07	x	0.63	x	0.7	=	131.77	(78)
South	0.9x	0.77	x	7.69	x	40.89	x	0.63	x	0.7	=	96.1	(78)
West	0.9x	0.77	x	1.42	x	19.87	x	0.63	x	0.7	=	17.25	(80)
West	0.9x	0.77	x	1.42	x	38.52	x	0.63	x	0.7	=	33.43	(80)
West	0.9x	0.77	x	1.42	x	61.57	x	0.63	x	0.7	=	53.43	(80)
West	0.9x	0.77	x	1.42	x	91.41	x	0.63	x	0.7	=	79.34	(80)
West	0.9x	0.77	x	1.42	x	111.22	x	0.63	x	0.7	=	96.53	(80)
West	0.9x	0.77	x	1.42	x	116.05	x	0.63	x	0.7	=	100.73	(80)
West	0.9x	0.77	x	1.42	x	112.64	x	0.63	x	0.7	=	97.77	(80)
West	0.9x	0.77	x	1.42	x	98.03	x	0.63	x	0.7	=	85.09	(80)
West	0.9x	0.77	x	1.42	x	73.6	x	0.63	x	0.7	=	63.88	(80)
West	0.9x	0.77	x	1.42	x	46.91	x	0.63	x	0.7	=	40.71	(80)
West	0.9x	0.77	x	1.42	x	24.71	x	0.63	x	0.7	=	21.44	(80)
West	0.9x	0.77	x	1.42	x	16.39	x	0.63	x	0.7	=	14.23	(80)

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

(83)m= 128.47 214.83 274.93 326.37 351.64 356.65 349.56 329.23 298.88 241.16 153.22 110.33 (83)

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

(84)m= 490.99 574.02 620.75 651.85 656.75 642.99 624.84 610.85 592.08 554.88 489.74 463.79 (84)

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

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a) (86)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.98	0.96	0.93	0.88	0.77	0.6	0.41	0.42	0.67	0.87	0.96	0.98

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)

(87)m= 19.52 19.79 20.11 20.45 20.77 20.94 20.99 20.99 20.9 20.56 19.96 19.58 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)

(88)m= 19.5 19.53 19.53 19.58 19.61 19.63 19.65 19.65 19.61 19.58 19.55 19.53 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)

(89)m= 0.97 0.94 0.9 0.84 0.69 0.49 0.28 0.29 0.56 0.82 0.95 0.97 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)

(90)m= 18.23 18.52 18.82 19.18 19.48 19.61 19.64 19.64 19.56 19.29 18.71 18.31 (90)

fLA = Living area + (4) = 0.56 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2 (92)

(92)m= 18.96 19.23 19.54 19.89 20.2 20.35 20.4 20.4 20.31 20 19.41 19.02 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)

(93)m= 18.96 19.23 19.54 19.89 20.2 20.35 20.4 20.4 20.31 20 19.41 19.02 (93)

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

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

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Utilisation factor for gains, hm:

(94)m=	0.96	0.94	0.9	0.85	0.73	0.55	0.35	0.36	0.62	0.83	0.94	0.97	(94)
--------	------	------	-----	------	------	------	------	------	------	------	------	------	------

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

(95)m=	473.69	540.5	561.63	551.97	477.47	353.29	221.53	221.3	365.21	463.26	462.1	448.67	(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=	1049.41	1008.25	902.82	757.37	559.12	373.14	224	223.97	398.07	622.63	858.8	1000.43	(97)
--------	---------	---------	--------	--------	--------	--------	-----	--------	--------	--------	-------	---------	------

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

(98)m=	428.33	314.33	253.85	147.88	60.75	0	0	0	0	118.57	285.63	410.51	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1..12} = 2019.85

49.26 (99)

Space heating requirement in kWh/m²/year

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 - (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) x [1 - (203)] =

1 (204)

Efficiency of main space heating system 1

89.9 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

kWh/year

Space heating requirement (calculated above)

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

428.33	314.33	253.85	147.88	60.75	0	0	0	0	118.57	285.63	410.51
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

(211)

(211)m = {[(98)m x (204)] + (210)m} x 100 ÷ (206)

476.45	349.64	282.37	164.5	67.58	0	0	0	0	131.89	317.72	456.63
--------	--------	--------	-------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1..12} =

2246.78 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214)m} x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---

Total (kWh/year) = Sum(215)_{1..12} =

0 (215)

Water heating

Output from water heater (calculated above)

157.72	137.77	143.34	127.13	123.08	108.4	103.85	115.77	117.05	133.29	142.29	154.01
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

79.8 (216)

Efficiency of water heater

(217)m=	86.94	86.56	85.97	84.93	82.88	79.8	79.8	79.8	79.8	84.26	86.27	86.9	(217)
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.41	159.16	166.72	149.69	148.51	135.84	130.14	145.08	146.68	158.2	164.94	177.23
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

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

1863.6 (219)

kWh/year

kWh/year

Annual totals

Space heating fuel used, main system 1

2246.78

Water heating fuel used

1863.6

Electricity for pumps, fans and electric keep-hot

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central heating pump:

boiler with a fan-assisted flue

Total electricity for the above, kWh/year

Electricity for lighting

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

130	(230c)
45	(230e)
175	(231)
195.32	(232)

Space heating - main system 1

Space heating - main system 2

Space heating - secondary

Water heating cost (other fuel)

Pumps, fans and electric keep-hot

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a)

Energy for lighting

Additional standing charges (Table 12)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost

Energy cost deflator (Table 12)

Energy cost factor (ECF)

SAP rating (Section 12)

Energy cost factor (ECF) calculation: $[(255) \times (256)] + [(4) + 45.0] =$

Space heating (main system 1)

Space heating (secondary)

Water heating

Space and water heating

Electricity for pumps, fans and electric keep-hot

Electricity for lighting

Total CO2, kg/year

CO2 emissions per m²

El rating (section 14)

Energy cost factor (ECF) calculation: $[(255) \times (256)] + [(4) + 45.0] =$

Space heating (main system 1)

Fuel
kWh/year

Fuel Price
(Table 12)

Fuel Cost
£/year

(211) x

(213) x

(215) x

(219)

(231)

(232)

3.1

0

0

3.1

11.46

11.46

x 0.01 = 69.6501 (240)

x 0.01 = 0 (241)

x 0.01 = 0 (242)

x 0.01 = 57.77 (247)

x 0.01 = 20.06 (249)

x 0.01 = 22.38 (250)

106 (251)

275.8602 (255)

0.47 (256)

1.5076 (257)

78.9689 (258)

$[(255) \times (256)] + [(4) + 45.0] =$

Energy
kWh/year

Emission factor
kg CO2/kWh

Emissions
kg CO2/year

(211) x

(215) x

(219) x

(261) + (262) + (263) + (264) =

(231) x

(232) x

0.198

0

0.198

0.517

0.517

sum of (265)...(271) =

(272) + (4) =

444.86 (261)

0 (263)

368.99 (264)

813.85 (265)

90.48 (267)

100.98 (268)

1005.31 (272)

24.52 (273)

84 (274)

Energy
kWh/year

Primary
factor

P. Energy
kWh/year

(211) x

1.02

2291.71 (261)

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Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	1900.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4192.58	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	570.33	(268)
'Total Primary Energy	sum of (265)...(271) =			5273.91	(272)
Primary energy kWh/m ² /year	(272) + (4) =			128.63	(273)

Predicted Energy Assessment



Plot 10
3 Marine Drive West
Bognor Regis
PO21

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

Enclosed end Top floor Flat
08 August 2013
Ondrej Gajdos
41 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.

Energy Efficiency Rating	Environmental Impact (CO ₂) Rating
Very energy efficient - lower running costs (92+) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not energy efficient - higher running costs 79	Very environmentally friendly - lower CO₂ emissions (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not environmentally friendly - higher CO₂ emissions 84
England & Wales EU Directive 2002/91/EC	England & Wales EU Directive 2002/91/EC

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.

SAP WorkSheet: New dwelling design stage

Assessor Name: Ondrej Gajdos

Stroma Number:

STRO006629

Software Name: Stroma FSAP 2009

Software Version:

Version: 1.5.0.49

Address : Plot 10, 3 Marine Drive West, Bognor Regis, PO21

	Area(m ²)	Ave Height(m)	Volume(m ³)
Ground floor	41 (1a)	2.4 (2a)	98.4 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	41 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	98.4 (5)

	main heating	Secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0.2 (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)

Additional infiltration

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

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

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration

$$0.25 - [0.2 \times (14) + 100] =$$

Infiltration rate

$$(8) + (10) + (11) + (12) + (13) + (15) =$$

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

If based on air permeability value, then (18) = [(17) + 20] + (8), otherwise (18) = (16)

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

Shelter factor

$$(20) = 1 - [0.075 \times (19)] =$$

Infiltration rate incorporating shelter factor

$$(21) = (18) \times (20) =$$

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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SAP WorkSheet: New dwelling design stage

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

1	0.94	0.94	0.83	0.76	0.72	0.68	0.68	0.78	0.83	0.89	0.94
---	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

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

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

0	(23a)
0	(23b)
0	(23c)

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

(24a)m=	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	(24b)
---------	---	---	---	---	---	---	---	---	---	---	---	-------

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

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	(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=	1	0.94	0.94	0.85	0.79	0.76	0.73	0.73	0.8	0.85	0.89	0.94	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	1	0.94	0.94	0.85	0.79	0.76	0.73	0.73	0.8	0.85	0.89	0.94	(25)
--------	---	------	------	------	------	------	------	------	-----	------	------	------	------

ELEMENT	Gross area (m²)	Openings m²	Net Area A, m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			1.32	x 1/[1/(1.5) + 0.04] =	1.87			(27)
Windows Type 2			7.69	x 1/[1/(1.5) + 0.04] =	10.88			(27)
Walls Type1	9.38	7.69	1.68	x 0.25 =	0.42			(29)
Walls Type2	8.88	0	8.88	x 0.27 =	2.36			(29)
Walls Type3	26	2.64	23.36	x 0.25 =	5.84			(29)
Roof Type1	16	0	16	x 0.15 =	2.4			(30)
Roof Type2	2.5	0	2.5	x 0.15 =	0.38			(30)
Roof Type3	22.8	0	22.8	x 0.15 =	3.42			(30)
Total area of elements, m²			85.555					(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) = 29.44 (33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm + TFA) in kJ/m²K

Indicative Value: Medium 250 (35)

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

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

12.83 (36)

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

Total fabric heat loss

(33) + (36) = 42.27 (37)

Ventilation heat loss calculated monthly

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

(38)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
	32.39	30.64	30.64	27.45	25.55	24.66	23.82	23.82	26.01	27.45	29	30.64	

Heat transfer coefficient, W/K

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

(39)m=	74.66	72.91	72.91	69.72	67.82	66.93	66.09	66.09	68.28	69.72	71.27	72.91	(39)
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Average = Sum(39) / 12 =

69.94 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.82	1.78	1.78	1.7	1.65	1.63	1.61	1.61	1.67	1.7	1.74	1.78	
Average = Sum(40) _{1...12} / 12 =													1.71

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)

Assumed occupancy, N

1.4332 (42)

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

if TFA ≤ 13.9, N = 1

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

71.829 (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)

(44)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	79.01	76.14	73.27	70.39	67.52	64.65	64.65	67.52	70.39	73.27	76.14	79.01	
Total = Sum(44) _{1...12} =													861.9484

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

(45)m=	117.45	102.72	106	92.42	88.68	76.52	70.91	81.37	82.34	95.96	104.75	113.75	
Total = Sum(45) _{1...12} =													1132.854

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

(46)m=	17.62	15.41	15.9	13.86	13.3	11.48	10.64	12.2	12.35	14.39	15.71	17.06	(46)
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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)

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	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

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

0 (58)

Primary circuit loss (annual) from Table 3

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

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

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

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

(61)m=	40.26	35.04	37.34	34.71	34.41	31.88	32.94	34.41	34.71	37.34	37.55	40.26	(61)
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SAP WorkSheet: New dwelling design stage

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

(62)m=	157.72	137.77	143.34	127.13	123.08	108.4	103.85	115.77	117.05	133.29	142.29	154.01	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
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Output from water heater

(64)m=	157.72	137.77	143.34	127.13	123.08	108.4	103.85	115.77	117.05	133.29	142.29	154.01	
Output from water heater (annual).....												1563.7102	(64)

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

(65)m=	49.12	42.92	44.58	39.41	38.09	33.41	31.81	35.66	36.06	41.24	44.21	47.89	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

Metabolic gains (Table 5), Watts

(66)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	85.99	

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

(67)m=	27.65	24.56	19.97	15.12	11.3	9.54	10.31	13.4	17.99	22.84	26.66	28.42	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	185.16	187.08	182.24	171.93	158.92	146.69	138.52	136.6	141.44	151.75	164.76	176.99	(68)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	45.03	(69)
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Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	-57.33	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	66.02	63.86	59.92	54.73	51.19	46.41	42.76	47.93	50.08	55.43	61.41	64.36	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains =

(73)m=	362.52	359.2	345.82	325.48	305.11	286.33	275.28	281.62	293.2	313.71	336.52	353.47	(73)
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Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Solar gains are calculated using Table 6a, 6b, 6c and 6d													
Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g _L Table 6b		FF Table 6c		Gains (W)		
East	0.9x	2	x	1.32	x	19.87	x	0.63	x	0.7	=	16.03	(76)
East	0.9x	2	x	1.32	x	38.52	x	0.63	x	0.7	=	31.08	(76)
East	0.9x	2	x	1.32	x	61.57	x	0.63	x	0.7	=	49.67	(76)
East	0.9x	2	x	1.32	x	91.41	x	0.63	x	0.7	=	73.75	(76)
East	0.9x	2	x	1.32	x	111.22	x	0.63	x	0.7	=	89.73	(76)
East	0.9x	2	x	1.32	x	116.05	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	2	x	1.32	x	112.64	x	0.63	x	0.7	=	90.88	(76)
East	0.9x	2	x	1.32	x	98.03	x	0.63	x	0.7	=	79.1	(76)

SAP WorkSheet: New dwelling design stage

East	0.9x	2	x	1.32	x	73.6	x	0.63	x	0.7	=	59.38	(76)
East	0.9x	2	x	1.32	x	46.91	x	0.63	x	0.7	=	37.85	(76)
East	0.9x	2	x	1.32	x	24.71	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	2	x	1.32	x	16.39	x	0.63	x	0.7	=	13.23	(76)
South	0.9x	0.77	x	7.69	x	47.32	x	0.63	x	0.7	=	111.22	(78)
South	0.9x	0.77	x	7.69	x	77.18	x	0.63	x	0.7	=	181.39	(78)
South	0.9x	0.77	x	7.69	x	94.25	x	0.63	x	0.7	=	221.49	(78)
South	0.9x	0.77	x	7.69	x	105.11	x	0.63	x	0.7	=	247.04	(78)
South	0.9x	0.77	x	7.69	x	108.55	x	0.63	x	0.7	=	255.11	(78)
South	0.9x	0.77	x	7.69	x	108.9	x	0.63	x	0.7	=	255.93	(78)
South	0.9x	0.77	x	7.69	x	107.14	x	0.63	x	0.7	=	251.79	(78)
South	0.9x	0.77	x	7.69	x	103.88	x	0.63	x	0.7	=	244.14	(78)
South	0.9x	0.77	x	7.69	x	99.99	x	0.63	x	0.7	=	235	(78)
South	0.9x	0.77	x	7.69	x	85.29	x	0.63	x	0.7	=	200.45	(78)
South	0.9x	0.77	x	7.69	x	56.07	x	0.63	x	0.7	=	131.77	(78)
South	0.9x	0.77	x	7.69	x	40.89	x	0.63	x	0.7	=	96.1	(78)

Solar gains in watts, calculated for each month

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

(83)m=	127.25	212.47	271.17	320.79	344.84	349.56	342.67	323.24	294.38	238.3	151.71	109.33	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m, watts

(84)m=	489.77	571.67	616.99	646.26	649.95	635.9	617.96	604.86	587.58	552.01	488.23	462.79	(84)
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Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.93	0.88	0.78	0.62	0.43	0.44	0.68	0.88	0.96	0.98	(86)

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

(87)m=	19.46	19.73	20.05	20.4	20.74	20.92	20.99	20.99	20.88	20.53	19.91	19.52	(87)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.46	19.49	19.49	19.55	19.58	19.59	19.61	19.61	19.57	19.55	19.52	19.49	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.97	0.95	0.91	0.85	0.71	0.5	0.29	0.29	0.57	0.83	0.95	0.97	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.15	18.43	18.74	19.11	19.42	19.56	19.61	19.61	19.52	19.22	18.63	18.23	(90)
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fLA = Living area + (4) =

0.56

(91)

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

(92)m=	18.89	19.16	19.48	19.83	20.16	20.33	20.38	20.38	20.28	19.95	19.35	18.95	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.89	19.16	19.48	19.83	20.16	20.33	20.38	20.38	20.28	19.95	19.35	18.95	(93)
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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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SAP WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	0.97	0.94	0.91	0.85	0.74	0.57	0.37	0.37	0.63	0.84	0.94	0.97	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	472.79	539.21	560.37	551.83	480.79	359.41	226.87	226.6	370.31	464.44	461.39	447.93	(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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Heat loss rate for mean internal temperature, Lm, W = [(39)m x ((93)m - (96)m)]

(97)m=	1074	1032.4	924.28	776.34	573.85	383.32	230.04	230	408.56	638.25	879.87	1024.53	(97)
--------	------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	---------	------

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

(98)m=	447.3	331.42	270.75	161.64	69.23	0	0	0	0	129.31	301.3	428.99	(98)
--------	-------	--------	--------	--------	-------	---	---	---	---	--------	-------	--------	------

Total per year (kWh/year) = Sum(98)_{1, 5, 9, 12} = 2139.96

Space heating requirement in kWh/m²/year

52.19 (99)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 - (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) x [1 - (203)] =

1 (204)

Efficiency of main space heating system 1

89.9 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

447.3	331.42	270.75	161.64	69.23	0	0	0	0	129.31	301.3	428.99
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(211)m = [(98)m x (204)] + (210)m x 100 + (206)

497.55	368.66	301.17	179.81	77.01	0	0	0	0	143.84	335.16	477.18
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1, 5, 9, 12} = 2380.38 (211)

Space heating fuel (secondary), kWh/month

= [(98)m x (201)] + (214)m x 100 + (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0
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Total (kWh/year) = Sum(215)_{1, 5, 9, 12} = 0 (215)

Water heating

Output from water heater (calculated above)

157.72	137.77	143.34	127.13	123.08	108.4	103.85	115.77	117.05	133.29	142.29	154.01
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Efficiency of water heater

79.8 (216)

(217)m=	87.03	86.68	86.13	85.16	83.16	79.8	79.8	79.8	79.8	84.47	86.39	86.99	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 + (217)m

(219)m=	181.22	158.94	166.43	149.29	148	135.84	130.14	145.08	146.68	157.79	164.71	177.04
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Total = Sum(219a)_{1, 12} = 1861.17 (219)

kWh/year

kWh/year

Annual totals

Space heating fuel used, main system 1

2380.38

Water heating fuel used

1861.17

Electricity for pumps, fans and electric keep-hot

SAP WorkSheet: New dwelling design stage

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		195.32	(232)

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.1	x 0.01 =	73.7919 (240)
Space heating - main system 2	(213) x	0	x 0.01 =	0 (241)
Space heating - secondary	(215) x	0	x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.1	x 0.01 =	57.7 (247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 =	20.06 (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 =	22.38 (250)
Additional standing charges (Table 12)				106 (251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)...(254) =	279.9265	(255)
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Energy cost deflator (Table 12)		0.47	(256)
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Energy cost factor (ECF)	[(255) x (256)] + [(4) + 45.0] =	1.5298	(257)
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SAP rating (Section 12)		78.6589	(258)
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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.198	=	471.32 (261)
Space heating (secondary)	(215) x	0	=	0 (263)
Water heating	(219) x	0.198	=	368.51 (264)
Space and water heating	(261) + (262) + (263) + (264) =			839.83 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48 (267)
Electricity for lighting	(232) x	0.517	=	100.98 (268)
Total CO2, kg/year			sum of (265)...(271) =	1031.28 (272)
CO2 emissions per m²			(272) + (4) =	25.15 (273)
EI rating (section 14)				84 (274)

	Energy kWh/year	Primary factor	P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.02	=	2427.99 (261)

SAP WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	1898.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4326.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	570.33	(268)
'Total Primary Energy		sum of (265)...(271) =		5407.71	(272)
Primary energy kWh/m ² /year		(272) + (4) =		131.9	(273)

Predicted Energy Assessment



Plot 11
3 Marine Drive West
Bognor Regis
PO21

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

Enclosed end Top floor Flat
08 August 2013
Ondrej Gajdos
37 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.

Energy Efficiency Rating	Environmental Impact (CO ₂) Rating
Very energy efficient - lower running costs 77 A B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not energy efficient - higher running costs	Very environmentally friendly - lower CO₂ emissions (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E F (1-20) G Not environmentally friendly - higher CO₂ emissions 83
England & Wales EU Directive 2002/91/EC	England & Wales EU Directive 2002/91/EC

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.

SAP WorkSheet: New dwelling design stage

Assessor Name: Ondrej Gajdos
Software Name: Stroma FSAP 2009

Stroma Number: STRO006629
Software Version: Version: 1.5.0.49

Address : Plot 11, 3 Marine Drive West, Bognor Regis, PO21

	Area(m ²)	Ave Height(m)	Volume(m ³)
Ground floor	37 (1a)	2.55 (2a)	94.35 (3a)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) (4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = (5)

	main heating	Secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans			2	2	20 (7a)
Number of passive vents			0	0	0 (7b)
Number of flueless gas fires			0	0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = + (5) = (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) (9)

Additional infiltration ((9)-1)x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (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 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration $0.25 - [0.2 \times (14) + 100] =$ (15)

Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ (16)

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

If based on air permeability value, then (18) = [(17) + 20]x(8), otherwise (18) = (16) (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 (19)

Shelter factor $(20) = 1 - [0.075 \times (19)] =$ (20)

Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ (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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SAP WorkSheet: New dwelling design stage

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

1.01	0.95	0.95	0.84	0.76	0.73	0.69	0.69	0.78	0.84	0.89	0.95
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

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

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

0	(23a)
0	(23b)
0	(23c)

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

(24a)m=	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	(24b)
---------	---	---	---	---	---	---	---	---	---	---	---	-------

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

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	(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=	1.01	0.95	0.95	0.85	0.79	0.76	0.74	0.74	0.81	0.85	0.9	0.95	(24d)
---------	------	------	------	------	------	------	------	------	------	------	-----	------	-------

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

(25)m=	1.01	0.95	0.95	0.85	0.79	0.76	0.74	0.74	0.81	0.85	0.9	0.95	(25)
--------	------	------	------	------	------	------	------	------	------	------	-----	------	------

ELEMENT Gross area (m²) Openings m² Net Area A, m² U-value W/m²K A X U (W/K) k-value kJ/m²·K A X k kJ/K

Windows Type 1

Windows Type 2

Windows Type 3

Walls Type1

Walls Type2

Roof Type1

Roof Type2

Total area of elements, m²

	36.53	5.26	31.27	x	0.25	=	7.82			(29)
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* 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) = 23.23 (33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm + TFA) in kJ/m²K

Indicative Value: Medium 250 (35)

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

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

12.47 (36)

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

(33) + (36) = 35.7 (37)

Total fabric heat loss

Ventilation heat loss calculated monthly

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	31.34	29.63	29.63	26.52	24.66	23.79	22.97	22.97	25.11	26.52	28.03	29.63	(38)

Heat transfer coefficient, W/K

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

(39)m=	67.04	65.33	65.33	62.22	60.36	59.49	58.67	58.67	60.81	62.22	63.73	65.33	
	Average = Sum(39) / 12 = 62.43												(39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.81	1.77	1.77	1.68	1.63	1.61	1.59	1.59	1.64	1.68	1.72	1.77	
Average = Sum(40) _{1..12} / 12 =													1.69

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)

Assumed occupancy, N

1.3291 (42)

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

if TFA ≤ 13.9, N = 1

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

69.2271 (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=	76.15	73.38	70.61	67.84	65.07	62.3	62.3	65.07	67.84	70.61	73.38	76.15	
Total = Sum(44) _{1..12} =													830.7253

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=	113.2	99	102.16	89.07	85.46	73.75	68.34	78.42	79.36	92.48	100.95	109.63	
Total = Sum(45) _{1..12} =													1091.8178

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

(46)m=	16.98	14.85	15.32	13.36	12.82	11.06	10.25	11.76	11.9	13.87	15.14	16.44	(46)
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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)

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	0	(56)
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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] + (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
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0 (58)

Primary circuit loss (annual) from Table 3

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

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

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

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

(61)m=	38.81	33.78	35.98	33.46	33.16	30.73	31.75	33.16	33.46	35.98	36.19	38.81	(61)
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SAP WorkSheet: New dwelling design stage

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

(62)m=	152	132.78	138.15	122.52	118.62	104.47	100.09	111.58	112.81	128.46	137.14	148.43	(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)
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Output from water heater

(64)m=	152	132.78	138.15	122.52	118.62	104.47	100.09	111.58	112.81	128.46	137.14	148.43	
Output from water heater (annual) Σ_{12}												1507.0666	(64)

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

(65)m=	47.34	41.36	42.96	37.98	36.71	32.2	30.66	34.36	34.75	39.75	42.61	46.15	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

Metabolic gains (Table 5), Watts

(66)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
	79.75	79.75	79.75	79.75	79.75	79.75	79.75	79.75	79.75	79.75	79.75	79.75	

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

(67)m=	27.18	24.14	19.64	14.87	11.11	9.38	10.14	13.18	17.69	22.46	26.21	27.94	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	170.25	172.02	167.57	158.09	146.13	134.88	127.37	125.6	130.05	139.53	151.5	162.74	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	(69)
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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=	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	63.63	61.55	57.75	52.75	49.34	44.73	41.21	46.19	48.26	53.42	59.18	62.03	(72)
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Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$

(73)m=	341.95	338.6	325.84	306.59	287.46	269.87	259.6	265.85	276.89	296.29	317.78	333.6	(73)
--------	--------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	------

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

Solar gains are calculated using the following formula:														
Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c				Gains (W)	
North	0.9x	0.77	x	1.47	x	10.73	x	0.63	x	0.7	=		4.82	(74)
North	0.9x	0.77	x	1.47	x	20.36	x	0.63	x	0.7	=		9.15	(74)
North	0.9x	0.77	x	1.47	x	33.31	x	0.63	x	0.7	=		14.96	(74)
North	0.9x	0.77	x	1.47	x	54.64	x	0.63	x	0.7	=		24.55	(74)
North	0.9x	0.77	x	1.47	x	75.22	x	0.63	x	0.7	=		33.79	(74)
North	0.9x	0.77	x	1.47	x	84.09	x	0.63	x	0.7	=		37.78	(74)
North	0.9x	0.77	x	1.47	x	79.12	x	0.63	x	0.7	=		35.54	(74)
North	0.9x	0.77	x	1.47	x	61.56	x	0.63	x	0.7	=		27.66	(74)

SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.47	x	41.09	x	0.63	x	0.7	=	18.46	(74)
North	0.9x	0.77	x	1.47	x	24.81	x	0.63	x	0.7	=	11.15	(74)
North	0.9x	0.77	x	1.47	x	13.22	x	0.63	x	0.7	=	5.94	(74)
North	0.9x	0.77	x	1.47	x	8.94	x	0.63	x	0.7	=	4.02	(74)
West	0.9x	0.77	x	1.42	x	19.87	x	0.63	x	0.7	=	17.25	(80)
West	0.9x	0.77	x	0.95	x	19.87	x	0.63	x	0.7	=	5.77	(80)
West	0.9x	0.77	x	1.42	x	38.52	x	0.63	x	0.7	=	33.43	(80)
West	0.9x	0.77	x	0.95	x	38.52	x	0.63	x	0.7	=	11.18	(80)
West	0.9x	0.77	x	1.42	x	61.57	x	0.63	x	0.7	=	53.43	(80)
West	0.9x	0.77	x	0.95	x	61.57	x	0.63	x	0.7	=	17.87	(80)
West	0.9x	0.77	x	1.42	x	91.41	x	0.63	x	0.7	=	79.34	(80)
West	0.9x	0.77	x	0.95	x	91.41	x	0.63	x	0.7	=	26.54	(80)
West	0.9x	0.77	x	1.42	x	111.22	x	0.63	x	0.7	=	96.53	(80)
West	0.9x	0.77	x	0.95	x	111.22	x	0.63	x	0.7	=	32.29	(80)
West	0.9x	0.77	x	1.42	x	116.05	x	0.63	x	0.7	=	100.73	(80)
West	0.9x	0.77	x	0.95	x	116.05	x	0.63	x	0.7	=	33.69	(80)
West	0.9x	0.77	x	1.42	x	112.64	x	0.63	x	0.7	=	97.77	(80)
West	0.9x	0.77	x	0.95	x	112.64	x	0.63	x	0.7	=	32.7	(80)
West	0.9x	0.77	x	1.42	x	98.03	x	0.63	x	0.7	=	85.09	(80)
West	0.9x	0.77	x	0.95	x	98.03	x	0.63	x	0.7	=	28.46	(80)
West	0.9x	0.77	x	1.42	x	73.6	x	0.63	x	0.7	=	63.88	(80)
West	0.9x	0.77	x	0.95	x	73.6	x	0.63	x	0.7	=	21.37	(80)
West	0.9x	0.77	x	1.42	x	46.91	x	0.63	x	0.7	=	40.71	(80)
West	0.9x	0.77	x	0.95	x	46.91	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.42	x	24.71	x	0.63	x	0.7	=	21.44	(80)
West	0.9x	0.77	x	0.95	x	24.71	x	0.63	x	0.7	=	7.17	(80)
West	0.9x	0.77	x	1.42	x	16.39	x	0.63	x	0.7	=	14.23	(80)
West	0.9x	0.77	x	0.95	x	16.39	x	0.63	x	0.7	=	4.76	(80)

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

(83)m=	27.84	53.76	86.27	130.42	162.61	172.2	166.01	141.21	103.71	65.48	34.56	23.01	(83)
--------	-------	-------	-------	--------	--------	-------	--------	--------	--------	-------	-------	-------	------

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

(84)m=	369.79	392.36	412.11	437.01	450.07	442.07	425.62	407.06	380.6	361.78	352.33	356.6	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	------

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

	21	(85)
--	----	------

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

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	0.99	0.98	0.97	0.94	0.87	0.73	0.54	0.56	0.82	0.94	0.98	0.99	

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

(87)m=	19.32	19.49	19.79	20.18	20.6	20.87	20.97	20.97	20.78	20.32	19.74	19.4	(87)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	------

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

(88)m=	19.47	19.5	19.5	19.56	19.59	19.61	19.63	19.63	19.59	19.56	19.53	19.5	(88)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

SAP WorkSheet: New dwelling design stage

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

(89)m=	0.98	0.98	0.96	0.92	0.82	0.62	0.37	0.39	0.72	0.92	0.97	0.98	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.02	18.21	18.51	18.93	19.34	19.55	19.62	19.62	19.48	19.06	18.48	18.12	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.54 (91)

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

(92)m=	18.72	18.9	19.2	19.61	20.02	20.26	20.35	20.35	20.18	19.74	19.16	18.81	(92)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.72	18.9	19.2	19.61	20.02	20.26	20.35	20.35	20.18	19.74	19.16	18.81	(93)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.96	0.92	0.83	0.68	0.46	0.48	0.77	0.92	0.97	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	361.87	381.48	393.81	402.98	375.58	298.87	196.61	195.6	291.88	332.9	341.57	349.19	(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 × {(93)m – (96)m}]

(97)m=	953.37	908.42	810.35	678.57	502.38	336.92	202.54	202.4	357.51	556.49	775.15	909.06	(97)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(98)m=	440.07	354.1	309.91	198.43	94.34	0	0	0	0	166.35	312.18	416.54	(98)
--------	--------	-------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1..5,9..12} = 2291.91 (98)

Space heating requirement in kWh/m²/year

61.94 (99)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1

89.9 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

kWh/year

Space heating requirement (calculated above)

440.07	354.1	309.91	198.43	94.34	0	0	0	0	166.35	312.18	416.54
--------	-------	--------	--------	-------	---	---	---	---	--------	--------	--------

(211)m = [(98)m × (204)] + (210)m × 100 ÷ (206) (211)

489.51	393.88	344.72	220.72	104.93	0	0	0	0	185.04	347.25	463.33
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1..5,10..12} = 2549.39 (211)

Space heating fuel (secondary), kWh/month

= [(98)m × (201)] + (214)m × 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	(215)
---------	---	---	---	---	---	---	---	---	---	---	---	---	-------

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

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

152	132.78	138.15	122.52	118.62	104.47	100.09	111.58	112.81	128.46	137.14	148.43
-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

(217)m=	87.07	86.9	86.52	85.76	83.98	79.8	79.8	79.8	79.8	85.2	86.56	87.01	79.8	(216)
---------	-------	------	-------	-------	-------	------	------	------	------	------	-------	-------	------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	174.57	152.79	159.66	142.88	141.25	130.92	125.42	139.82	141.37	150.78	158.44	170.6
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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

1788.51 (219)

Annual totals

Space heating fuel used, main system 1

2549.39

Water heating fuel used

1788.51

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

192.03

(232)

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
--	------------------	--------------------------	---------------------

Space heating - main system 1

(211) x

3.1

x 0.01 =

79.0312

(240)

Space heating - main system 2

(213) x

0

x 0.01 =

0

(241)

Space heating - secondary

(215) x

0

x 0.01 =

0

(242)

Water heating cost (other fuel)

(219)

3.1

x 0.01 =

55.44

(247)

Pumps, fans and electric keep-hot

(231)

11.46

x 0.01 =

20.06

(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 =

22.01

(250)

Additional standing charges (Table 12)

106

(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost

(245)...(247) + (250)...(254) =

282.537

(255)

Energy cost deflator (Table 12)

0.47

(256)

Energy cost factor (ECF)

[(255) x (256)] ÷ [(4) + 45.0] =

1.6194

(257)

SAP rating (Section 12)

77.4091

(258)

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

Space heating (main system 1)

(211) x

0.198

=

504.78

(261)

SAP WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0	=	0	(263)
Water heating	(219) x	0.198	=	354.13	(264)
Space and water heating	(261) + (262) + (263) + (264) =			858.91	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48	(267)
Electricity for lighting	(232) x	0.517	=	99.28	(268)
Total CO2, kg/year		sum of (265)...(271) =		1048.66	(272)
CO2 emissions per m²		(272) + (4) =		28.34	(273)
EI rating (section 14)				83	(274)

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	Energy kWh/year	Primary factor	=	P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.02	=	2600.38	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	1824.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4424.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	560.73	(268)
Total Primary Energy		sum of (265)...(271) =		5496.4	(272)
Primary energy kWh/m²/year		(272) + (4) =		148.55	(273)

SAP WorkSheet: New dwelling design stage

Assessor Name: Ondrej Gajdos

Stroma Number:

STRO006629

Software Name: Stroma FSAP 2009

Software Version:

Version: 1.5.0.49

Address : Plot 12, 3 Marine Drive West, Bognor Regis, PO21

	Area(m²)		Ave Height(m)		Volume(m³)
Ground floor	32	(1a) x	2.55	(2a) =	81.6

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)

32

(4)

Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =

81.6

(5)

	main heating	Secondary heating	other	total		m³ per hour
Number of chimneys	0	0	0	0	x 40 =	0
Number of open flues	0	0	0	0	x 20 =	0
Number of intermittent fans				2	x 10 =	20
Number of passive vents				0	x 10 =	0
Number of flueless gas fires				0	x 40 =	0

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =

20

+ (5) =

0.25

(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

15

(17)

If based on air permeability value, then (18) = [(17) + 20]÷(8), otherwise (18) = (16)

1

(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

3

(19)

Shelter factor

(20) = 1 - [0.075 x (19)] =

0.78

(20)

Infiltration rate incorporating shelter factor

(21) = (18) x (20) =

0.77

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

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

SAP WorkSheet: New dwelling design stage

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

1.04	0.98	0.98	0.87	0.79	0.75	0.71	0.71	0.81	0.87	0.93	0.98
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) + 100]

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

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

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

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

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

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

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 1.04 0.98 0.98 0.88 0.81 0.78 0.75 0.75 0.83 0.88 0.93 0.98 (24d)

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

(25)m= 1.04 0.98 0.98 0.88 0.81 0.78 0.75 0.75 0.83 0.88 0.93 0.98 (25)

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A, m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² ·K	A X k kJ/K
Windows Type 1			1.44	x1/[1/(1.5)+0.04] =	2.04		(27)
Windows Type 2			1.47	x1/[1/(1.5)+0.04] =	2.08		(27)
Walls Type1	30.55	4.35	26.19	x 0.25 =	6.55		(29)
Walls Type2	9.44	0	9.44	x 0.27 =	2.51		(29)
Roof Type1	7.9	0	7.9	x 0.15 =	1.18		(30)
Roof Type2	25	0	25	x 0.15 =	3.75		(30)
Total area of elements, m ²			72.876				(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) = 20.15 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 10.93 (36)

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

Total fabric heat loss (33) + (36) = 31.08 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	28.04	26.48	26.48	23.6	21.88	21.08	20.32	20.32	22.29	23.6	25	26.48

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

(39)m=	59.12	57.56	57.56	54.68	52.96	52.16	51.4	51.4	53.37	54.68	56.08	57.56
Average = Sum(39).../12=												54.88 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.85	1.8	1.8	1.71	1.66	1.63	1.61	1.61	1.67	1.71	1.75	1.8	
Average = Sum(40) _{1..12} / 12 =													1.71

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)

Assumed occupancy, N

1.2137

(42)

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

if TFA ≤ 13.9, N = 1

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

66.3421

(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=	72.98	70.32	67.67	65.02	62.36	59.71	59.71	62.36	65.02	67.67	70.32	72.98	
Total = Sum(44) _{1..12} =													796.105

(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=	108.48	94.88	97.91	85.36	81.9	70.67	65.49	75.15	76.05	88.63	96.74	105.06	
Total = Sum(45) _{1..12} =													1046.3165

(45)

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

(46)m=	16.27	14.23	14.69	12.8	12.29	10.6	9.82	11.27	11.41	13.29	14.51	15.76	(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

$$(47) \times (48) =$$

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

$$((50) \times (51) \times (52) \times (53) =$$

0

(54)

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	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

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

(61)m=	37.19	32.37	34.48	32.06	31.78	29.44	30.43	31.78	32.06	34.48	34.68	37.19	(61)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

SAP WorkSheet: New dwelling design stage

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

(62)m=	145.67	127.25	132.39	117.42	113.68	100.12	95.92	106.93	108.11	123.11	131.42	142.25	(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=	145.67	127.25	132.39	117.42	113.68	100.12	95.92	106.93	108.11	123.11	131.42	142.25	
Output from water heater (annual), Σ													1444.2599 (64)

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

(65)m=	45.37	39.64	41.17	36.4	35.18	30.86	29.38	32.93	33.3	38.09	40.84	44.23	(65)
--------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	------

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	72.82	72.82	72.82	72.82	72.82	72.82	72.82	72.82	72.82	72.82	72.82	72.82	(66)

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

(67)m=	24.56	21.81	17.74	13.43	10.04	8.48	9.16	11.9	15.98	20.29	23.68	25.24	(67)
--------	-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

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

(68)m=	152.33	153.91	149.92	141.44	130.74	120.68	113.96	112.38	116.36	124.84	135.54	145.61	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	43.5	43.5	43.5	43.5	43.5	43.5	43.5	43.5	43.5	43.5	43.5	43.5	(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=	-48.55	-48.55	-48.55	-48.55	-48.55	-48.55	-48.55	-48.55	-48.55	-48.55	-48.55	-48.55	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	60.98	58.99	55.34	50.55	47.28	42.86	39.49	44.26	46.25	51.2	56.72	59.45	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(73)m=	315.63	312.48	300.78	283.2	265.83	249.79	240.38	246.32	256.36	274.09	293.71	308.07	(73)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

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 _s Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.47	x	10.73	x	0.63	x	0.7	=	4.82 (74)
North	0.9x	0.77	x	1.47	x	20.36	x	0.63	x	0.7	=	9.15 (74)
North	0.9x	0.77	x	1.47	x	33.31	x	0.63	x	0.7	=	14.96 (74)
North	0.9x	0.77	x	1.47	x	54.64	x	0.63	x	0.7	=	24.55 (74)
North	0.9x	0.77	x	1.47	x	75.22	x	0.63	x	0.7	=	33.79 (74)
North	0.9x	0.77	x	1.47	x	84.09	x	0.63	x	0.7	=	37.78 (74)
North	0.9x	0.77	x	1.47	x	79.12	x	0.63	x	0.7	=	35.54 (74)
North	0.9x	0.77	x	1.47	x	61.56	x	0.63	x	0.7	=	27.66 (74)

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North	0.9x	0.77	x	1.47	x	41.09	x	0.63	x	0.7	=	18.46	(74)
North	0.9x	0.77	x	1.47	x	24.81	x	0.63	x	0.7	=	11.15	(74)
North	0.9x	0.77	x	1.47	x	13.22	x	0.63	x	0.7	=	5.94	(74)
North	0.9x	0.77	x	1.47	x	8.94	x	0.63	x	0.7	=	4.02	(74)
East	0.9x	2	x	1.44	x	19.87	x	0.63	x	0.7	=	17.49	(76)
East	0.9x	2	x	1.44	x	38.52	x	0.63	x	0.7	=	33.9	(76)
East	0.9x	2	x	1.44	x	61.57	x	0.63	x	0.7	=	54.19	(76)
East	0.9x	2	x	1.44	x	91.41	x	0.63	x	0.7	=	80.46	(76)
East	0.9x	2	x	1.44	x	111.22	x	0.63	x	0.7	=	97.89	(76)
East	0.9x	2	x	1.44	x	116.05	x	0.63	x	0.7	=	102.15	(76)
East	0.9x	2	x	1.44	x	112.64	x	0.63	x	0.7	=	99.14	(76)
East	0.9x	2	x	1.44	x	98.03	x	0.63	x	0.7	=	86.29	(76)
East	0.9x	2	x	1.44	x	73.6	x	0.63	x	0.7	=	64.78	(76)
East	0.9x	2	x	1.44	x	46.91	x	0.63	x	0.7	=	41.29	(76)
East	0.9x	2	x	1.44	x	24.71	x	0.63	x	0.7	=	21.75	(76)
East	0.9x	2	x	1.44	x	16.39	x	0.63	x	0.7	=	14.43	(76)

Solar gains in watts, calculated for each month

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

(83)m=	22.31	43.05	69.15	105	131.68	139.92	134.69	113.94	83.24	52.44	27.68	18.45	(83)
--------	-------	-------	-------	-----	--------	--------	--------	--------	-------	-------	-------	-------	------

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

(84)m=	337.94	355.53	369.93	388.2	397.51	389.71	375.07	360.26	339.6	326.53	321.4	326.51	(84)
--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	-------	--------	------

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

21 (85)

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

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	0.98	0.98	0.97	0.94	0.87	0.73	0.53	0.55	0.81	0.94	0.98	0.98	

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

(87)m=	19.33	19.5	19.79	20.18	20.6	20.86	20.97	20.97	20.78	20.33	19.75	19.41	(87)
--------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.44	19.48	19.48	19.54	19.58	19.6	19.61	19.61	19.57	19.54	19.51	19.48	(88)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.98	0.97	0.95	0.92	0.81	0.61	0.37	0.38	0.71	0.91	0.97	0.98	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18	18.2	18.49	18.91	19.32	19.54	19.61	19.61	19.46	19.06	18.48	18.11	(90)
--------	----	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area + (4) = 0.47 (91)

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

(92)m=	18.62	18.81	19.1	19.51	19.92	20.16	20.25	20.25	20.08	19.65	19.08	18.72	(92)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.62	18.81	19.1	19.51	19.92	20.16	20.25	20.25	20.08	19.65	19.08	18.72	(93)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

SAP WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	0.97	0.97	0.95	0.92	0.83	0.66	0.45	0.46	0.75	0.91	0.96	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	329.36	344.15	351.63	355.66	328.35	258.65	167.42	166.7	255.04	297.28	309.84	318.39	(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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Heat loss rate for mean internal temperature, Lm, W = [(39)m x ((93)m - (96)m)]

(97)m=	834.92	794.7	708.01	590.82	435.44	289.99	172.04	171.93	308.45	484.1	677.13	795.6	(97)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	------

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

(98)m=	376.14	302.77	265.15	169.32	79.68	0	0	0	0	138.99	264.44	355.04	
Total per year (kWh/year) = Sum(98) _{1..5,9..12} =												1951.53	(98)

Space heating requirement in kWh/m²/year

60.99 (99)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 - (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) x [1 - (203)] =

1 (204)

Efficiency of main space heating system 1

89.9 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

376.14	302.77	265.15	169.32	79.68	0	0	0	0	138.99	264.44	355.04
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] + (210)m} x 100 ÷ (206)

(211)

418.4	336.78	294.94	188.34	88.63	0	0	0	0	154.6	294.15	394.93
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Total (kWh/year) = Sum(211)_{1..5,10..12} =

2170.78 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214)m} x 100 ÷ (208)

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

0 (215)

Water heating

Output from water heater (calculated above)

145.67	127.25	132.39	117.42	113.68	100.12	95.92	106.93	108.11	123.11	131.42	142.25
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

Efficiency of water heater

79.8 (216)

(217)m=	86.83	86.65	86.26	85.47	83.67	79.8	79.8	79.8	79.8	84.86	86.27	86.76	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	167.76	146.84	153.47	137.38	135.86	125.46	120.2	134	135.48	145.08	152.33	163.95
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Total = Sum(219a)_{1..12} =

1717.82 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

2170.78

Water heating fuel used

1717.82

Electricity for pumps, fans and electric keep-hot

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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		173.5 (232)

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.1	x 0.01 =	67.2942 (240)
Space heating - main system 2	(213) x	0	x 0.01 =	0 (241)
Space heating - secondary	(215) x	0	x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.1	x 0.01 =	53.25 (247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 =	20.06 (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 =	19.88 (250)
Additional standing charges (Table 12)				106 (251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)...(254) =	266.4844 (255)
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Energy cost deflator (Table 12)		0.47 (256)
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Energy cost factor (ECF)	[(255) x (256)] + [(4) + 45.0] =	1.6266 (257)
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SAP rating (Section 12)		77.309 (258)
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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.198	=	429.81 (261)
Space heating (secondary)	(215) x	0	=	0 (263)
Water heating	(219) x	0.198	=	340.13 (264)
Space and water heating	(261) + (262) + (263) + (264) =			769.94 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48 (267)
Electricity for lighting	(232) x	0.517	=	89.7 (268)
Total CO2, kg/year		sum of (265)...(271) =		950.12 (272)
CO2 emissions per m²		(272) + (4) =		29.69 (273)
EI rating (section 14)				83 (274)

	Energy kWh/year	Primary factor	P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.02	=	2214.19 (261)

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Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	1752.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =			3966.37	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	506.62	(268)
Total Primary Energy	sum of (265)...(271) =			4983.98	(272)
Primary energy kWh/m ² /year	(272) + (4) =			155.75	(273)

Predicted Energy Assessment

SAP

Plot 12
3 Marine Drive West
Bognor Regis
PO21

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

Enclosed end Top floor Flat
08 August 2013
Ondrej Gajdos
32 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.

Energy Efficiency Rating	Environmental Impact (CO ₂) Rating
Very energy efficient - lower running costs A B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not energy efficient - higher running costs 77	Very environmentally friendly - lower CO₂ emissions (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not environmentally friendly - higher CO₂ emissions 83
England & Wales EU Directive 2002/91/EC	England & Wales EU Directive 2002/91/EC

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.