



Your Reference : 5267

Will Pearce
HJP Surveyors
Grove House
64 Sutton Grove
Sutton
SM1 4LP

Therm Energy Limited
1 Tarrant Street
Arundel
West Sussex
BN18 9DG

Our Reference : YE-19

Sent By : E-Mail

5 March 2021

Dear Will

Re : 53 High Street, Bognor Regis PO21 1RX - Planning Condition 7

CO2 (Part L Compliant)

Total = 13,775.62 kg

CO2 (Renewables = Solar PV)

Total = 12,395.42 kg

Saving = 1,380.20 kg = 10.02%

CO2 (Fabric First)

Total = 12,338.30 kg

Saving = 1,437.32 kg = 10.43%

The fabric first approach has a greater saving in CO2 emissions (10.43%) compared to the renewables approach (10.02%), therefore the proposed meets the requirements of Planning Condition 7 (see SAP calculations attached).

I trust this is satisfactory. Should you have any queries, or would like to discuss anything, please do not hesitate to contact me.

Yours sincerely

Joe Solti (Project Director) joe@thermenergy.co.uk

Construction and Insulation

<u>Element</u>	<u>U-Value</u> (W/m ² K)
<u>Exposed Wall</u> (external) Solid brick + 60mm Gyproc ThermoLine Super (on plaster dabs).	0.30
<u>Exposed Wall</u> (flat-retail front) Twin metal I-stud + 50mm Isover APR 1200 insulation between + 15mm soundbloc plasterboard (2 layers) both sides.	0.25
<u>Exposed Wall</u> (flat-retail adjoining) Solid brick + 30mm Gyproc ThermoLine Super (on plaster dabs) one side.	0.30
<u>Party Walls</u> (flat-common) Twin metal I-stud + 50mm Isover APR 1200 insulation between + 15mm soundbloc plasterboard (2 layers) both sides.	0.20
<u>Party Walls</u> (flat-flat adjoining) Solid brick + plaster both sides.	0.00
<u>Ground Floor</u> (Flat 1) Screed + 90mm PIR insulation + solid concrete floor.	0.19
<u>First Floor</u> (Flat 2 - Over Shop) 18mm chipboard + 19mm plasterboard plank + 25mm Isover resilient layer + 12mm plywood + suspended timber joists (100mm Isover APR 1200 insulation between) + resilient bars + soundbloc plasterboard (2 layers).	0.14
<u>Roof</u> (pitched) 300mm mineral wool insulation quilt (150mm between joists + 150mm cross-laid over joists).	0.15
<u>Roof</u> (flat) 120mm Celotex Crown (over roof deck).	0.18
<u>Windows</u> (front) Timber frame single-glazed (subject to Building Control approval).	4.80
<u>Windows</u> (rear) PVC-u frame double-glazed + 16mm cavity (argon gas fill) + soft coat low-E glass + warm edge spacer.	1.40
<u>Doors</u> (rear) PVC-u frame double-glazed + 16mm cavity (argon gas fill) + soft coat low-E glass.	1.80

Heating & VentilationMain Heating System

Electric panel heaters (direct acting) - standard tariff electric. Programmer + appliance thermostats. No secondary heating.

Ventilation

Background ventilators + intermittent extract fans (Approved Document F1, 2010, amended 2013).

OtherLighting

Min 75% of internal light fittings are low-energy (lamp luminous efficacy > 45 lumens/circuit watt, total output > 400 lamp lumens).

Water Use

Total water use < 125 litres/person/day.

Air Tightness

Part L1B - air pressure test not required.

SAP Input

Property Details: YCI 991A

Address: Flat 1, 53 High Street, Bognor Regis, PO21 1RX
Located in: England
Region: South East England
UPRN:
Date of assessment: 05 March 2021
Date of certificate: 05 March 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/ person/ day: True
PCDF Version: 471

Property description

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 54.2 m² 2.7 m
Living area: 28.9 m² (fraction 0.533)
Front of dwelling faces: South West

Opening types

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (SE)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (SW)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	16mm or more mm	0.7	0.63	1.8	1.8	1
Windows (SE)	16mm or more	0.7	0.63	1.6	2.1	1
Windows (SW)	16mm or more	0.7	0.63	1.6	4.9	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall (external)	South West	0	0
Windows (SE)		Wall (external)	South East	0	0
Windows (SW)		Wall (external)	South West	0	0

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall (external)	52.5	8.8	43.7	0.3	0	False	N/A
Wall (retail)	43.4	0	43.4	0.7	0	False	N/A
Wall (retail) stud	9.1	0	9.1	0.28	0	False	N/A
Roof (flat)	2.9	0	2.9	0.25	0		N/A
Ground Floor	54.2			0.25			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							

Thermal Bridges

SAP Input

Thermal bridges: No information on thermal bridging (y= 0.15) (y = 0.15)

Ventilation:

Pressure test: No (Assumed)
 Ventilation: Natural ventilation (extract fans)
 Number of chimneys: 0
 Number of open flues: 0
 Number of fans: 2
 Number of passive stacks: 0
 Number of sides sheltered: 4
 Pressure test: 15

Main heating system:

Main heating system: Room heaters
 Electric (direct acting) room heaters
 Fuel: Electricity
 Info Source: SAP Tables
 SAP Table: 691
 Panel, convector or radiant heaters
 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature > 45°C
 Unknown
 Boiler interlock: Yes

Main heating Control:

Main heating Control: Programmer and appliance thermostats
 Control code: 2603

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
 Water code: 903
 Fuel :Electricity
 Hot water cylinder
 Cylinder volume: 200 litres
 Cylinder insulation: Measured loss, 2.24kWh/day
 Primary pipework insulation: False
 Cylinderstat: True
 Cylinder in heated space: True
 Immersion: Single
 Solar panel: False

Others:

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 75%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: None
 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: 4E1901A

Address : Flat 1, 53 High Street, Bognor Regis, PO21 1RX

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	54.2 (1a)	2.7 (2a)	146.34 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.2 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	146.34 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				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) =	0.14 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.89 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.62 (21)

Infiltration rate modified for monthly wind speed

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

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

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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SAP WorkSheet: New dwelling design stage

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

0.79	0.78	0.76	0.68	0.67	0.59	0.59	0.57	0.62	0.67	0.7	0.73
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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= 0.81 0.8 0.79 0.73 0.72 0.67 0.67 0.66 0.69 0.72 0.74 0.77 (24d)

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

(25)m= 0.81 0.8 0.79 0.73 0.72 0.67 0.67 0.66 0.69 0.72 0.74 0.77 (25)

3. Heat losses and heat capacity parameter

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.8	1.8	3.24		(26)
Windows Type 1			2.1	$\times 1/[1/(1.6) + 0.04]$	3.16		(27)
Windows Type 2			4.9	$\times 1/[1/(1.6) + 0.04]$	7.37		(27)
Floor			54.2	0.25	13.55		(28)
Walls Type1	52.5	8.8	43.7	0.3	13.11		(29)
Walls Type2	43.4	0	43.4	0.7	30.38		(29)
Walls Type3	9.1	0	9.1	0.28	2.55		(29)
Roof	2.9	0	2.9	0.25	0.73		(30)
Total area of elements, m²			162.1				(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) = 74.08 (33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) = 14754.8 (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

24.32 (36)

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

Total fabric heat loss

(33) + (36) = 98.39 (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=	39.27	38.68	38.1	35.4	34.9	32.54	32.54	32.1	33.45	34.9	35.92	36.99

Heat transfer coefficient, W/K

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

(39)m=	137.66	137.07	136.5	133.8	133.29	130.94	130.94	130.5	131.84	133.29	134.31	135.38
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SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$\{40\}m = \{39\}m + \{4\}$$

{40}m=	2.54	2.53	2.52	2.47	2.46	2.42	2.42	2.41	2.43	2.46	2.48	2.5		
	Average = Sum{40} / 12 =												2.47	{40}

Number of days in month (Table 1a)

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

4 Water heating energy requirement

Assumed occupancy, N

1.81

{42}

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

if TFA ≤ 13.9, N = 1

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

77.28

{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=	85.01	81.92	78.83	75.73	72.64	69.55	69.55	72.64	75.73	78.83	81.92	85.01		
	Total = Sum{44} =												927.36	{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=	126.06	110.26	113.77	99.19	95.18	82.13	76.11	87.33	88.38	102.99	112.42	122.09		
	Total = Sum{45} =												1215.91	{45}

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

{46}m=	18.91	16.54	17.07	14.88	14.28	12.32	11.42	13.1	13.26	15.45	16.86	18.31		{46}
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Water storage loss:

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

200

{47}

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

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

Water storage loss:

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

2.24

{48}

Temperature factor from Table 2b

0.6

{49}

Energy lost from water storage, kWh/year

$$\{48\} \times \{49\} =$$

1.34

{50}

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

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

0

{51}

If community heating see section 4.3

Volume factor from Table 2a

0

{52}

Temperature factor from Table 2b

0

{53}

Energy lost from water storage, kWh/year

$$\{47\} \times \{51\} \times \{52\} \times \{53\} =$$

0

{54}

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

1.34

{55}

Water storage loss calculated for each month

$$\{56\}m = \{55\} \times \{41\}m$$

{56}m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{57}
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Primary circuit loss (annual) from Table 3

0

{58}

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

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

{59}m=	0	0	0	0	0	0	0	0	0	0	0	0		{59}
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SAP WorkSheet: New dwelling design stage

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	167.73	147.89	155.44	139.51	136.84	122.45	117.77	129	128.7	144.66	152.74	163.75	(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	(63)
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Output from water heater

(64)m=	167.73	147.89	155.44	139.51	136.84	122.45	117.77	129	128.7	144.66	152.74	163.75	
Output from water heater (annual): 1.12												1706.47	(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=	75.25	66.77	71.16	65.24	64.98	59.56	58.64	62.37	61.64	67.58	69.64	73.92	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	(66)

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

(67)m=	47.95	42.59	34.64	26.22	19.6	16.55	17.88	23.24	31.19	39.61	46.23	49.28	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	236	238.45	232.28	219.14	202.56	186.97	176.56	174.11	180.28	193.42	210	225.59	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	(71)
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Water heating gains (Table 5)

(72)m=	101.14	99.35	95.65	90.61	87.34	82.73	78.81	83.83	85.61	90.83	96.72	99.36	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	469.07	464.37	446.54	419.95	393.47	370.22	357.22	365.15	381.06	407.83	436.92	458.21	(73)
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6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g _s Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.54	×	2.1	×	36.79	×	0.63	×	0.7	×	16.56	(77)
Southeast 0.9x	0.54	×	2.1	×	62.67	×	0.63	×	0.7	×	28.21	(77)
Southeast 0.9x	0.54	×	2.1	×	85.75	×	0.63	×	0.7	×	38.6	(77)
Southeast 0.9x	0.54	×	2.1	×	106.25	×	0.63	×	0.7	×	47.82	(77)
Southeast 0.9x	0.54	×	2.1	×	119.01	×	0.63	×	0.7	×	53.56	(77)

SAP WorkSheet: New dwelling design stage

Southeast 0.9x	0.54	x	2.1	x	118.15	x	0.63	x	0.7	=	53.18	(77)
Southeast 0.9x	0.54	x	2.1	x	113.91	x	0.63	x	0.7	=	51.27	(77)
Southeast 0.9x	0.54	x	2.1	x	104.39	x	0.63	x	0.7	=	46.98	(77)
Southeast 0.9x	0.54	x	2.1	x	92.85	x	0.63	x	0.7	=	41.79	(77)
Southeast 0.9x	0.54	x	2.1	x	69.27	x	0.63	x	0.7	=	31.18	(77)
Southeast 0.9x	0.54	x	2.1	x	44.07	x	0.63	x	0.7	=	19.84	(77)
Southeast 0.9x	0.54	x	2.1	x	31.49	x	0.63	x	0.7	=	14.17	(77)
Southwest 0.9x	0.54	x	4.9	x	36.79		0.63	x	0.7	=	38.64	(79)
Southwest 0.9x	0.54	x	4.9	x	62.67		0.63	x	0.7	=	65.82	(79)
Southwest 0.9x	0.54	x	4.9	x	85.75		0.63	x	0.7	=	90.06	(79)
Southwest 0.9x	0.54	x	4.9	x	106.25		0.63	x	0.7	=	111.59	(79)
Southwest 0.9x	0.54	x	4.9	x	119.01		0.63	x	0.7	=	124.98	(79)
Southwest 0.9x	0.54	x	4.9	x	118.15		0.63	x	0.7	=	124.08	(79)
Southwest 0.9x	0.54	x	4.9	x	113.91		0.63	x	0.7	=	119.63	(79)
Southwest 0.9x	0.54	x	4.9	x	104.39		0.63	x	0.7	=	109.63	(79)
Southwest 0.9x	0.54	x	4.9	x	92.85		0.63	x	0.7	=	97.51	(79)
Southwest 0.9x	0.54	x	4.9	x	69.27		0.63	x	0.7	=	72.74	(79)
Southwest 0.9x	0.54	x	4.9	x	44.07		0.63	x	0.7	=	46.28	(79)
Southwest 0.9x	0.54	x	4.9	x	31.49		0.63	x	0.7	=	33.07	(79)

Solar gains in watts, calculated for each month

$$(83)m = \text{Sum}(74)m \dots (82)m$$

(83)m=	55.2	94.03	128.65	159.41	178.55	177.26	170.9	156.62	139.3	103.92	66.12	47.24	(83)
--------	------	-------	--------	--------	--------	--------	-------	--------	-------	--------	-------	-------	------

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

(84)m=	524.27	558.4	575.19	579.35	572.02	547.48	528.12	521.77	520.37	511.75	503.04	505.45	(84)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.98	0.97	0.94	0.88	0.78	0.79	0.9	0.96	0.98	0.99	(86)

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

(87)m=	18.54	18.71	19.04	19.52	20.02	20.5	20.77	20.74	20.38	19.75	19.09	18.53	(87)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19	19	19.01	19.04	19.04	19.07	19.07	19.08	19.06	19.04	19.03	19.02	(88)
--------	----	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.98	0.98	0.97	0.95	0.9	0.77	0.55	0.58	0.82	0.94	0.98	0.99	(89)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

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

(90)m=	15.94	16.19	16.67	17.39	18.09	18.73	19	18.98	18.59	17.72	16.76	15.95	(90)
--------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	------

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

0.53 (91)

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

(92)m=	17.33	17.53	17.93	18.52	19.12	19.67	19.94	19.92	19.55	18.8	18	17.33	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	----	-------	------

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

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(93)m=	17.33	17.53	17.93	18.52	19.12	19.67	19.94	19.92	19.55	18.8	18	17.33	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	----	-------	------

8. Space heating calculation

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

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

Utilisation factor for gains, h_m :

(94)m=	0.98	0.97	0.96	0.94	0.9	0.81	0.67	0.7	0.85	0.94	0.97	0.98	(94)
--------	------	------	------	------	-----	------	------	-----	------	------	------	------	------

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

(95)m=	512.63	542.82	553.35	545.77	515.5	444.32	354.33	363.01	441.8	479.56	487.37	495.36	(95)
--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1793.32	1731.46	1560.59	1287.73	988.85	664.14	437.41	459.19	718.34	1093.64	1464	1776.97	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	---------	------	---------	------

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

(98)m=	952.83	798.77	749.39	534.21	352.18	0	0	0	0	456.87	703.17	953.52	
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 5500.92 (98)

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

101.49 (99)

9. Space heating systems, including micro CHP

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

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

1 (202)

Fraction of total heating from main system 1

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

1 (204)

Efficiency of main space heating system 1

100 (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)

952.83	798.77	749.39	534.21	352.18	0	0	0	0	456.87	703.17	953.52
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

952.83	798.77	749.39	534.21	352.18	0	0	0	0	456.87	703.17	953.52
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total ($kWh/year$) = $Sum(211)_{1..12} =$ 5500.92 (211)

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

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

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

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

Water heating

Output from water heater (calculated above)

167.73	147.89	155.44	139.51	136.84	122.45	117.77	129	128.7	144.66	152.74	163.75
--------	--------	--------	--------	--------	--------	--------	-----	-------	--------	--------	--------

Efficiency of water heater

100 (216)

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

Fuel for water heating, $kWh/month$

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

(219)m=	167.73	147.89	155.44	139.51	136.84	122.45	117.77	129	128.7	144.66	152.74	163.75	
---------	--------	--------	--------	--------	--------	--------	--------	-----	-------	--------	--------	--------	--

Total = $Sum(219a)_{1..12} =$ 1706.47 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

5500.92

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Water heating fuel used		1706.47
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0 (231)
Electricity for lighting		338.72 (232)

10a Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19	725.57 (240)
Space heating - main system 2	(213) x	0	0 (241)
Space heating - secondary	(215) x	13.19	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	225.08 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Pumps, fans and electric keep-hot	(231)	13.19 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)	13.19 x 0.01 =	44.68 (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) =		995.33 (255)

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	4.21 (257)
SAP rating (Section 12)		41.41 (258)

12a CO2 emissions - individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	2854.98 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	885.66 (264)
Space and water heating	(261) + (262) + (263) + (264) =		3740.64 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	0 (267)
Electricity for lighting	(232) x	0.519	175.8 (268)
Total CO2, kg/year		sum of (265)...(271) =	3916.43 (272)
CO2 emissions per m²		(272) ÷ (4) =	72.26 (273)

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El rating (section 14)

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{274}

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	{211} x	3.07	=	16887.84	{261}
Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	5238.87	{264}
Space and water heating	{261} + {262} + {263} + {264} =			22126.7	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	0	{267}
Electricity for lighting	{232} x	0	=	1039.88	{268}
'Total Primary Energy		sum of {265}...{271} =		23166.58	{272}
Primary energy kWh/m ² /year		{272} ÷ {4} =		427.43	{273}

SAP Input

Property Details: YC1 9Q2A

Address: Flat 2, 53 High Street, Bognor Regis, PO21 1RX
Located in: England
Region: South East England
UPRN:
Date of assessment: 05 March 2021
Date of certificate: 05 March 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/ person/ day: True
PCDF Version: 471

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 40.7 m² 3.1 m
Living area: 21.4 m² (fraction 0.526)
Front of dwelling faces: North East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Windows (NW)	SAP 2012	Windows	Single-glazed	No	Wood
Windows (SE)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Windows (NW)		0.7	0.85	4.8	5.1	1
Windows (SE)	16mm or more	0.7	0.63	1.6	2.1	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Windows (NW)		Wall (external)	North West	0	0
Windows (SE)		Wall (external)	South West	0	0

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall (external)	20.5	7.2	13.3	0.3	0	False	N/A
Wall (retail)	31.7	0	31.7	0.7	0	False	N/A
Floor Over Shop	36.1			0.25			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
Party Wall	12.9						N/A
Party Wall	28.9						N/A

Thermal Bridging

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Ventilation

Pressure test: No (Assumed)

SAP Input

Ventilation: Natural ventilation (extract fans)
 Number of chimneys: 0
 Number of open flues: 0
 Number of fans: 2
 Number of passive stacks: 0
 Number of sides sheltered: 3
 Pressure test: 15

Main heating system

Main heating system: Room heaters
 Electric (direct acting) room heaters
 Fuel: Electricity
 Info Source: SAP Tables
 SAP Table: 691
 Panel, convector or radiant heaters

 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature > 45°C
 Unknown
 Boiler interlock: Yes

Main heating Control

Main heating Control: Programmer and appliance thermostats
 Control code: 2603

Secondary heating system

Secondary heating system: None

Water heating

Water heating: Electric immersion (on-peak or off-peak)
 Water code: 903
 Fuel :Electricity
 Hot water cylinder
 Cylinder volume: 200 litres
 Cylinder insulation: Measured loss, 2.24kWh/day
 Primary pipework insulation: False
 Cylinderstat: True
 Cylinder in heated space: True
 Immersion: Single
 Solar panel: False

Others

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 75%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: None
 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: 4E1902A

Address : Flat 2, 53 High Street, Bognor Regis, PO21 1RX

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	40.7 (1a)	3.1 (2a)	126.17 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	40.7 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	126.17 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				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) =	0.16 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.91 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.7 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

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

0.9	0.88	0.86	0.77	0.76	0.67	0.67	0.65	0.7	0.76	0.79	0.83
-----	------	------	------	------	------	------	------	-----	------	------	------

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= 0.9 0.89 0.87 0.8 0.79 0.72 0.72 0.71 0.75 0.79 0.81 0.84 (24d)

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

(25)m= 0.9 0.89 0.87 0.8 0.79 0.72 0.72 0.71 0.75 0.79 0.81 0.84 (25)

3. Heat losses and heat loss parameter

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			5.1	$\times 1/[1/(4.8) + 0.04] =$	20.54		(27)
Windows Type 2			2.1	$\times 1/[1/(1.6) + 0.04] =$	3.16		(27)
Floor			36.1	$\times$ 0.25	9.025		(28)
Walls Type1	20.5	7.2	13.3	$\times$ 0.3	3.99		(29)
Walls Type2	31.7	0	31.7	$\times$ 0.7	22.19		(29)
Total area of elements, m²			88.3				(31)
Party wall			12.9	$\times$ 0	0		(32)
Party wall			28.9	$\times$ 0.2	5.78		(32)

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

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

Fabric heat loss, W/K = S (A x U) (26) ... (30) + (32) = 64.68 (33)

Heat capacity Cm = S(A x k) ((23)...(30) + (32) + (32a)...(32e) = 9764.7 (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 13.25 (36)

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

Total fabric heat loss (33) + (36) = 77.92 (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=	37.6	36.94	36.31	33.31	32.74	30.13	30.13	29.65	31.14	32.74	33.88	35.07

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

(39)m=	115.52	114.87	114.23	111.23	110.67	108.06	108.06	107.57	109.06	110.67	111.8	112.99
Average = Sum(39) / 12 =	111.23											(39)

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Heat loss parameter (HLP), W/m²K

$$\{40\}m = \{39\}m + \{4\}$$

{40}m=	2.84	2.82	2.81	2.73	2.72	2.65	2.65	2.64	2.68	2.72	2.75	2.78		
	Average = Sum{40}/12=												2.73	{40}

Number of days in month (Table 1a)

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

4 Water heating energy requirement

Assumed occupancy, N

1.43

{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

68.05

{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=	74.85	72.13	69.41	66.68	63.96	61.24	61.24	63.96	66.68	69.41	72.13	74.85		
	Total = Sum{44}/12 =												816.54	{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=	111	97.08	100.18	87.34	83.8	72.32	67.01	76.9	77.82	90.69	98.99	107.5		
	Total = Sum{45}/12 =												1070.62	{45}

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

{46}m=	16.65	14.56	15.03	13.1	12.57	10.85	10.05	11.53	11.67	13.6	14.85	16.12		{46}
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	--	------

Water storage loss:

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

200

{47}

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

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

Water storage loss:

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

2.24

{48}

Temperature factor from Table 2b

0.6

{49}

Energy lost from water storage, kWh/year

$$\{48\} \times \{49\} =$$

1.34

{50}

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

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

0

{51}

If community heating see section 4.3

Volume factor from Table 2a

0

{52}

Temperature factor from Table 2b

0

{53}

Energy lost from water storage, kWh/year

$$\{47\} \times \{51\} \times \{52\} \times \{53\} =$$

0

{54}

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

1.34

{55}

Water storage loss calculated for each month

$$\{56\}m = \{55\} \times \{41\}m$$

{56}m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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 × (41)m

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

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

(62)m=	152.66	134.71	141.84	127.66	125.47	112.64	108.68	118.56	118.14	132.35	139.31	149.16	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

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

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

Output from water heater

(64)m=	152.66	134.71	141.84	127.66	125.47	112.64	108.68	118.56	118.14	132.35	139.31	149.16	
Output from water heater (annual): 1.12												1561.18	(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=	70.24	62.39	66.64	61.3	61.2	56.3	55.61	58.9	58.13	63.48	65.17	69.07	(65)
--------	-------	-------	-------	------	------	------	-------	------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	(66)

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

(67)m=	35	31.09	25.28	19.14	14.31	12.08	13.05	16.97	22.77	28.92	33.75	35.98	(67)
--------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(68)m=	184.03	185.94	181.12	170.88	157.95	145.79	137.67	135.76	140.58	150.82	163.75	175.91	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-57	-57	-57	-57	-57	-57	-57	-57	-57	-57	-57	-57	(71)
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

Water heating gains (Table 5)

(72)m=	94.41	92.84	89.57	85.13	82.25	78.2	74.75	79.17	80.74	85.33	90.51	92.84	(72)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	386.91	383.34	369.46	348.63	327.99	309.55	298.95	305.37	317.56	338.54	361.49	378.2	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest 0.9x	0.54	x	2.1	x	36.79		0.63	x	0.7	=	16.56	(79)
Southwest 0.9x	0.54	x	2.1	x	62.67		0.63	x	0.7	=	28.21	(79)
Southwest 0.9x	0.54	x	2.1	x	85.75		0.63	x	0.7	=	38.6	(79)
Southwest 0.9x	0.54	x	2.1	x	106.25		0.63	x	0.7	=	47.82	(79)
Southwest 0.9x	0.54	x	2.1	x	119.01		0.63	x	0.7	=	53.56	(79)

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Southwest 0.9x	0.54	x	2.1	x	118.15	0.63	x	0.7	=	53.18	(79)
Southwest 0.9x	0.54	x	2.1	x	113.91	0.63	x	0.7	=	51.27	(79)
Southwest 0.9x	0.54	x	2.1	x	104.39	0.63	x	0.7	=	46.98	(79)
Southwest 0.9x	0.54	x	2.1	x	92.85	0.63	x	0.7	=	41.79	(79)
Southwest 0.9x	0.54	x	2.1	x	69.27	0.63	x	0.7	=	31.18	(79)
Southwest 0.9x	0.54	x	2.1	x	44.07	0.63	x	0.7	=	19.84	(79)
Southwest 0.9x	0.54	x	2.1	x	31.49	0.63	x	0.7	=	14.17	(79)
Northwest 0.9x	0.77	x	5.1	x	11.28	0.85	x	0.7	=	23.73	(81)
Northwest 0.9x	0.77	x	5.1	x	22.97	0.85	x	0.7	=	48.3	(81)
Northwest 0.9x	0.77	x	5.1	x	41.38	0.85	x	0.7	=	87.02	(81)
Northwest 0.9x	0.77	x	5.1	x	67.96	0.85	x	0.7	=	142.9	(81)
Northwest 0.9x	0.77	x	5.1	x	91.35	0.85	x	0.7	=	192.09	(81)
Northwest 0.9x	0.77	x	5.1	x	97.38	0.85	x	0.7	=	204.79	(81)
Northwest 0.9x	0.77	x	5.1	x	91.1	0.85	x	0.7	=	191.58	(81)
Northwest 0.9x	0.77	x	5.1	x	72.63	0.85	x	0.7	=	152.73	(81)
Northwest 0.9x	0.77	x	5.1	x	50.42	0.85	x	0.7	=	106.03	(81)
Northwest 0.9x	0.77	x	5.1	x	28.07	0.85	x	0.7	=	59.02	(81)
Northwest 0.9x	0.77	x	5.1	x	14.2	0.85	x	0.7	=	29.85	(81)
Northwest 0.9x	0.77	x	5.1	x	9.21	0.85	x	0.7	=	19.38	(81)

Solar gains in watts, calculated for each month

$$(83)m = \text{Sum}(74)m \dots (82)m$$

(83)m=	40.29	76.51	125.61	190.73	245.66	257.97	242.85	199.71	147.82	90.2	49.69	33.55	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	------	-------	-------	------

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

(84)m=	427.2	459.84	495.07	539.36	573.64	567.51	541.8	505.09	465.38	428.74	411.18	411.75	(84)
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.95	0.9	0.8	0.68	0.73	0.88	0.96	0.98	0.99	(86)

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

(87)m=	18.34	18.53	18.92	19.5	20.08	20.57	20.81	20.77	20.38	19.67	18.94	18.34	(87)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	18.83	18.84	18.85	18.89	18.9	18.93	18.93	18.94	18.92	18.9	18.88	18.87	(88)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	------

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

(89)m=	0.98	0.97	0.96	0.92	0.84	0.66	0.43	0.49	0.77	0.93	0.97	0.98	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	15.58	15.85	16.42	17.28	18.06	18.68	18.89	18.87	18.48	17.53	16.48	15.6	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

0.53 (91)

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

(92)m=	17.03	17.26	17.73	18.45	19.12	19.68	19.9	19.87	19.48	18.65	17.77	17.04	(92)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

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(93)m=	17.03	17.26	17.73	18.45	19.12	19.68	19.9	19.87	19.48	18.65	17.77	17.04	(93)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

8. Space heating calculation

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

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

Utilisation factor for gains, h_m :

(94)m=	0.97	0.96	0.95	0.91	0.84	0.72	0.57	0.62	0.81	0.92	0.96	0.97	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	415.34	443.73	469.9	492.77	484.47	408.74	307.52	310.69	376.92	395.76	395.45	401.41	(95)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1470.33	1419.6	1283.05	1062.1	821.41	548.42	356.31	373.07	586.66	891.38	1193.27	1451.07	(97)
--------	---------	--------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	784.91	655.78	604.98	409.91	250.69	0	0	0	0	368.74	574.43	780.95	
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	--

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

4430.39 (98)

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

108.85 (99)

9. Space heating requirements - individual heating systems (including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

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

1 (202)

Fraction of total heating from main system 1

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

1 (204)

Efficiency of main space heating system 1

100 (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)

784.91	655.78	604.98	409.91	250.69	0	0	0	0	368.74	574.43	780.95
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

784.91	655.78	604.98	409.91	250.69	0	0	0	0	368.74	574.43	780.95
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

4430.39 (211)

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

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

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

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

0 (215)

Water heating

Output from water heater (calculated above)

152.66	134.71	141.84	127.66	125.47	112.64	108.68	118.56	118.14	132.35	139.31	149.16
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

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

Fuel for water heating, $kWh/month$

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

(219)m=	152.66	134.71	141.84	127.66	125.47	112.64	108.68	118.56	118.14	132.35	139.31	149.16	
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

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

1561.18 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

4430.39

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Water heating fuel used		1561.18	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0	(231)
Electricity for lighting		247.28	(232)

10a Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =	584.37 (240)
Space heating - main system 2	(213) x	0	x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0 (242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1	(243)
Low-rate fraction	1.0 - (243) =		0	(244)
High-rate cost	(219) x (243) x	13.19	x 0.01 =	205.92 (245)
Low-rate cost	(219) x (244) x	13.19	x 0.01 =	0 (246)
Pumps, fans and electric keep-hot	(231)	13.19	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)	13.19	x 0.01 =	32.62 (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) =			822.9 (255)

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	4.03	(257)
SAP rating (Section 12)		43.72	(258)

12a CO2 emissions - individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	2299.37 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.519	=	810.25 (264)
Space and water heating	(261) + (262) + (263) + (264) =			3109.62 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0 (267)
Electricity for lighting	(232) x	0.519	=	128.34 (268)
Total CO2, kg/year			sum of (265)...(271) =	3237.96 (272)
CO2 emissions per m²			(272) ÷ (4) =	79.56 (273)

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El rating (section 14)

50

{274}

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	{211} x	3.07	=	13601.3	{261}
Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	4792.81	{264}
Space and water heating	{261} + {262} + {263} + {264} =			18394.11	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	0	{267}
Electricity for lighting	{232} x	0	=	759.14	{268}
'Total Primary Energy		sum of {265}...{271} =		19153.25	{272}
Primary energy kWh/m ² /year		{272} ÷ {4} =		470.6	{273}

SAP Input

Property Details: YCI 903A

Address: Flat 3, 53 High Street, Bognor Regis, PO21 1RX
Located in: England
Region: South East England
UPRN:
Date of assessment: 05 March 2021
Date of certificate: 05 March 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/ person/ day: True
PCDF Version: 471

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 51.1 m² 2.6 m
Living area: 22.4 m² (fraction 0.438)
Front of dwelling faces: North West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Windows (SE)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (SW)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Windows (SE)	16mm or more	0.7	0.63	1.6	2.9	1
Windows (SW)	16mm or more	0.7	0.63	1.6	5.6	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Windows (SE)		Wall (external)	South East	0	0
Windows (SW)		Wall (external)	South West	0	0

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall (external)	48.1	8.5	39.6	0.3	0	False	N/A
Roof	51.1	0	51.1	0.25	0		N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
Party Wall	39.3						N/A
Party Wall	8.8						N/A

Thermal bridges

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Ventilation

Pressure test: No (Assumed)

SAP Input

Ventilation: Natural ventilation (extract fans)
 Number of chimneys: 0
 Number of open flues: 0
 Number of fans: 2
 Number of passive stacks: 0
 Number of sides sheltered: 3
 Pressure test: 15

Main heating system

Main heating system: Room heaters
 Electric (direct acting) room heaters
 Fuel: Electricity
 Info Source: SAP Tables
 SAP Table: 691
 Panel, convector or radiant heaters
 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature > 45°C
 Unknown
 Boiler interlock: Yes

Main heating Control

Main heating Control: Programmer and appliance thermostats
 Control code: 2603

Secondary heating system

Secondary heating system: None

Water heating

Water heating: Electric immersion (on-peak or off-peak)
 Water code: 903
 Fuel :Electricity
 Hot water cylinder
 Cylinder volume: 200 litres
 Cylinder insulation: Measured loss, 2.24kWh/day
 Primary pipework insulation: False
 Cylinderstat: True
 Cylinder in heated space: True
 Immersion: Single
 Solar panel: False

Others

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 75%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: None
 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: 4E1903A

Address : Flat 3, 53 High Street, Bognor Regis, PO21 1RX

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.1 (1a)	2.6 (2a)	132.86 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.1 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	132.86 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				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) =	0.15 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.9 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.7 (21)

Infiltration rate modified for monthly wind speed

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

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

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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SAP WorkSheet: New dwelling design stage

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

0.89	0.87	0.85	0.77	0.75	0.66	0.66	0.65	0.7	0.75	0.79	0.82
------	------	------	------	------	------	------	------	-----	------	------	------

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)m x 0.5]

(24d)m= 0.9 0.88 0.87 0.79 0.78 0.72 0.72 0.71 0.74 0.78 0.81 0.84 (24d)

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

(25)m= 0.9 0.88 0.87 0.79 0.78 0.72 0.72 0.71 0.74 0.78 0.81 0.84 (25)

3. Heat losses and heat capacity parameter

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			2.9	$\times 1/[1/(1.6) + 0.04] =$	4.36		(27)
Windows Type 2			5.6	$\times 1/[1/(1.6) + 0.04] =$	8.42		(27)
Walls	48.1	8.5	39.6	$\times$ 0.3	11.88		(29)
Roof	51.1	0	51.1	$\times$ 0.25	12.77		(30)
Total area of elements, m ²			99.2				(31)
Party wall			39.3	$\times$ 0	0		(32)
Party wall			8.8	$\times$ 0.2	1.76		(32)

* 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) = 39.2 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 8066.3 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 14.88 (36)

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

Total fabric heat loss (33) + (36) = 54.08 (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=	39.28	38.61	37.95	34.84	34.26	31.56	31.56	31.06	32.6	34.26	35.44	36.66

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

(39)m=	93.36	92.68	92.02	88.92	88.34	85.64	85.64	85.14	86.68	88.34	89.51	90.74
Average = Sum(39)...12/12=												88.92 (39)

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Heat loss parameter (HLP), W/m²K

$$\{40\}m = \{39\}m + \{4\}$$

{40}m=	1.83	1.81	1.8	1.74	1.73	1.68	1.68	1.67	1.7	1.73	1.75	1.78		
Average = Sum{40} / 12 =													1.74	{40}

Number of days in month (Table 1a)

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

4 Water heating energy requirement

Assumed occupancy, N

1.72

{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

75.11

{43}

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
{44}m=	82.62	79.62	76.61	73.61	70.6	67.6	67.6	70.6	73.61	76.61	79.62	82.62		
Total = Sum{44} / 12 =													901.32	{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=	122.52	107.16	110.58	96.41	92.5	79.82	73.97	84.88	85.89	100.1	109.27	118.66		
Total = Sum{45} / 12 =													1181.77	{45}

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

{46}m=	18.38	16.07	16.59	14.46	13.88	11.97	11.1	12.73	12.88	15.02	16.39	17.8		{46}
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Water storage loss:

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

200

{47}

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

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

Water storage loss:

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

2.24

{48}

Temperature factor from Table 2b

0.6

{49}

Energy lost from water storage, kWh/year

$$\{48\} \times \{49\} =$$

1.34

{50}

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

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

0

{51}

If community heating see section 4.3

Volume factor from Table 2a

0

{52}

Temperature factor from Table 2b

0

{53}

Energy lost from water storage, kWh/year

$$\{47\} \times \{51\} \times \{52\} \times \{53\} =$$

0

{54}

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

1.34

{55}

Water storage loss calculated for each month

$$\{56\}m = \{55\} \times \{41\}m$$

{56}m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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 × (41)m

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

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

(62)m=	164.19	144.79	152.24	136.73	134.17	120.14	115.63	126.54	126.21	141.77	149.59	160.32	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

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

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

(64)m=	164.19	144.79	152.24	136.73	134.17	120.14	115.63	126.54	126.21	141.77	149.59	160.32	
Output from water heater (annual): 1.12												1672.33	(64)

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

(65)m=	74.07	65.74	70.1	64.31	64.09	58.8	57.93	61.55	60.82	66.61	68.59	72.79	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	(66)

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

(67)m=	44.51	39.53	32.15	24.34	18.19	15.36	16.6	21.57	28.95	36.76	42.91	45.74	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	224.02	226.34	220.48	208.01	192.27	177.47	167.59	165.27	171.12	183.59	199.34	214.13	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	(71)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water heating gains (Table 5)

(72)m=	99.56	97.82	94.22	89.32	86.14	81.66	77.86	82.73	84.47	89.54	95.26	97.83	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains =

(73)m=	449.59	445.2	428.36	403.18	378.11	356	343.55	351.08	366.05	391.4	419.01	439.21	(73)
--------	--------	-------	--------	--------	--------	-----	--------	--------	--------	-------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g _g Table 6b	FF Table 6c	Gains (W)	
Southeast 0.9x	0.77	2.9	36.79	0.63	0.7	32.61	(77)
Southeast 0.9x	0.77	2.9	62.67	0.63	0.7	55.55	(77)
Southeast 0.9x	0.77	2.9	85.75	0.63	0.7	76	(77)
Southeast 0.9x	0.77	2.9	106.25	0.63	0.7	94.17	(77)
Southeast 0.9x	0.77	2.9	119.01	0.63	0.7	105.48	(77)

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Southeast 0.9x	0.77	x	2.9	x	118.15	x	0.63	x	0.7	=	104.71	(77)
Southeast 0.9x	0.77	x	2.9	x	113.91	x	0.63	x	0.7	=	100.96	(77)
Southeast 0.9x	0.77	x	2.9	x	104.39	x	0.63	x	0.7	=	92.52	(77)
Southeast 0.9x	0.77	x	2.9	x	92.85	x	0.63	x	0.7	=	82.29	(77)
Southeast 0.9x	0.77	x	2.9	x	69.27	x	0.63	x	0.7	=	61.39	(77)
Southeast 0.9x	0.77	x	2.9	x	44.07	x	0.63	x	0.7	=	39.06	(77)
Southeast 0.9x	0.77	x	2.9	x	31.49	x	0.63	x	0.7	=	27.91	(77)
Southwest 0.9x	0.54	x	5.6	x	36.79		0.63	x	0.7	=	44.16	(79)
Southwest 0.9x	0.54	x	5.6	x	62.67		0.63	x	0.7	=	75.22	(79)
Southwest 0.9x	0.54	x	5.6	x	85.75		0.63	x	0.7	=	102.92	(79)
Southwest 0.9x	0.54	x	5.6	x	106.25		0.63	x	0.7	=	127.53	(79)
Southwest 0.9x	0.54	x	5.6	x	119.01		0.63	x	0.7	=	142.84	(79)
Southwest 0.9x	0.54	x	5.6	x	118.15		0.63	x	0.7	=	141.81	(79)
Southwest 0.9x	0.54	x	5.6	x	113.91		0.63	x	0.7	=	136.72	(79)
Southwest 0.9x	0.54	x	5.6	x	104.39		0.63	x	0.7	=	125.29	(79)
Southwest 0.9x	0.54	x	5.6	x	92.85		0.63	x	0.7	=	111.44	(79)
Southwest 0.9x	0.54	x	5.6	x	69.27		0.63	x	0.7	=	83.14	(79)
Southwest 0.9x	0.54	x	5.6	x	44.07		0.63	x	0.7	=	52.89	(79)
Southwest 0.9x	0.54	x	5.6	x	31.49		0.63	x	0.7	=	37.79	(79)

Solar gains in watts, calculated for each month

$$(83)m = \text{Sum}(74)m \dots (82)m$$

(83)m=	76.77	130.77	178.92	221.69	248.32	246.52	237.67	217.81	193.74	144.53	91.95	65.7	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	526.36	575.97	607.28	624.87	626.43	602.53	581.22	568.89	559.79	535.93	510.97	504.91	(84)
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7 Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.94	0.88	0.75	0.6	0.63	0.81	0.94	0.98	0.99	(86)

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

(87)m=	19.3	19.48	19.77	20.19	20.55	20.84	20.95	20.94	20.76	20.31	19.77	19.31	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.45	19.46	19.47	19.51	19.52	19.56	19.56	19.57	19.54	19.52	19.5	19.49	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.97	0.95	0.91	0.82	0.64	0.42	0.46	0.72	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=	17.3	17.56	17.99	18.6	19.09	19.46	19.54	19.54	19.37	18.79	18.01	17.33	(90)
--------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

0.44 (91)

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

(92)m=	18.18	18.4	18.77	19.3	19.73	20.06	20.16	20.16	19.98	19.45	18.78	18.2	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.18	18.4	18.77	19.3	19.73	20.06	20.16	20.16	19.98	19.45	18.78	18.2	(93)
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8. Space heating calculation

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

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

(94)m=	0.97	0.96	0.95	0.91	0.83	0.68	0.5	0.53	0.75	0.91	0.96	0.98	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

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

(95)m=	513.17	555.64	574.73	567.34	521.34	410.18	291.42	302.8	419.91	485.27	491	493.84	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	1295.33	1251.46	1129.28	924.59	709.47	467.81	304.82	319.76	509.69	782.04	1045.44	1270.33	(97)
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Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	581.92	467.59	412.58	257.22	139.97	0	0	0	0	220.8	399.2	577.7	
--------	--------	--------	--------	--------	--------	---	---	---	---	-------	-------	-------	--

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

3056.99 (98)

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

59.82 (99)

9. Space heating requirements - individual heating systems (including micro CHP)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

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

1 (202)

Fraction of total heating from main system 1

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

1 (204)

Efficiency of main space heating system 1

100 (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)

581.92	467.59	412.58	257.22	139.97	0	0	0	0	220.8	399.2	577.7
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(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

581.92	467.59	412.58	257.22	139.97	0	0	0	0	220.8	399.2	577.7
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Total ($kWh/year$) = $Sum(211)_{1..12} =$

3056.99 (211)

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

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

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

0 (215)

Water heating

Output from water heater (calculated above)

164.19	144.79	152.24	136.73	134.17	120.14	115.63	126.54	126.21	141.77	149.59	160.32
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Efficiency of water heater

100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	(217)
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Fuel for water heating, $kWh/month$

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

(219)m=	164.19	144.79	152.24	136.73	134.17	120.14	115.63	126.54	126.21	141.77	149.59	160.32	
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Total = $Sum(219a)_{1..12} =$

1672.33 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3056.99

SAP WorkSheet: New dwelling design stage

Water heating fuel used		1672.33	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0	(231)
Electricity for lighting		314.4	(232)

10a Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19	403.22 (240)
Space heating - main system 2	(213) x	0	0 (241)
Space heating - secondary	(215) x	13.19	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19	220.58 (245)
Low-rate cost	(219) x (244) x	13.19	0 (246)
Pumps, fans and electric keep-hot	(231)	13.19	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)	13.19	41.47 (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) =		665.27 (255)

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	2.91	(257)
SAP rating (Section 12)		59.44	(258)

12a CO2 emissions - individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	1586.58 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	867.94 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2454.52 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	0 (267)
Electricity for lighting	(232) x	0.519	163.17 (268)
Total CO2, kg/year		sum of (265)...(271) =	2617.69 (272)
CO2 emissions per m²		(272) ÷ (4) =	51.23 (273)

SAP WorkSheet: New dwelling design stage

El rating (section 14)

63

(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	{211} x	3.07	=	9384.95	{261}
Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	5134.05	{264}
Space and water heating	{261} + {262} + {263} + {264} =			14519	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	0	{267}
Electricity for lighting	{232} x	0	=	965.21	{268}
'Total Primary Energy	sum of {265}...{271} =			15484.21	{272}
Primary energy kWh/m ² /year	{272} ÷ {4} =			303.02	{273}

SAP Input

Property Details: YC1 9Q4A

Address: Flat 4, 53 High Street, Bognor Regis, PO21 1RX
Located in: England
Region: South East England
UPRN:
Date of assessment: 05 March 2021
Date of certificate: 05 March 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/ person/ day: True
PCDF Version: 471

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 47.2 m² 2.7 m
Living area: 20.9 m² (fraction 0.443)
Front of dwelling faces: South East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Windows (NW)	SAP 2012	Windows	Single-glazed	No	Wood
Windows (SE)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Windows (NW)		0.7	0.85	4.8	4.6	1
Windows (SE)	16mm or more	0.7	0.63	1.6	2.1	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Windows (NW)		Wall (external)	North West	0	0
Windows (SE)		Wall (external)	South West	0	0

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall (external)	50.3	6.7	43.6	0.3	0	False	N/A
Roof	47.2	0	47.2	0.25	0		N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
Party Wall	19.8						N/A
Party Wall	16.8						N/A

Thermal Bridges

Thermal bridges: No information on thermal bridging (y=0.15) (y=0.15)

Ventilation

Pressure test: No (Assumed)

SAP Input

Ventilation: Natural ventilation (extract fans)
 Number of chimneys: 0
 Number of open flues: 0
 Number of fans: 2
 Number of passive stacks: 0
 Number of sides sheltered: 1
 Pressure test: 15

Main heating system

Main heating system: Room heaters
 Electric (direct acting) room heaters
 Fuel: Electricity
 Info Source: SAP Tables
 SAP Table: 691
 Panel, convector or radiant heaters

 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature > 45°C
 Unknown
 Boiler interlock: Yes

Main heating Control

Main heating Control: Programmer and appliance thermostats
 Control code: 2603

Secondary heating system

Secondary heating system: None

Water heating

Water heating: Electric immersion (on-peak or off-peak)
 Water code: 903
 Fuel :Electricity
 Hot water cylinder
 Cylinder volume: 200 litres
 Cylinder insulation: Measured loss, 2.24kWh/day
 Primary pipework insulation: False
 Cylinderstat: True
 Cylinder in heated space: True
 Immersion: Single
 Solar panel: False

Others

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 75%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: None
 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: 4E1904A

Address : Flat 4, 53 High Street, Bognor Regis, PO21 1RX

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	47.2 (1a)	2.7 (2a)	127.44 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	47.2 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	127.44 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				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) =	0.16 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.91 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.84 (21)

Infiltration rate modified for monthly wind speed

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

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

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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SAP WorkSheet: New dwelling design stage

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

1.07	1.05	1.03	0.92	0.9	0.8	0.8	0.78	0.84	0.9	0.94	0.99
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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= 1.07 1.05 1.03 0.93 0.91 0.82 0.82 0.8 0.85 0.91 0.95 0.99 (24d)

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

(25)m= 1.07 1.05 1.03 0.93 0.91 0.82 0.82 0.8 0.85 0.91 0.95 0.99 (25)

3. Heat losses and heat capacity parameter

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			4.6	$\times 1/[1/(4.8) + 0.04] =$	18.52		(27)
Windows Type 2			2.1	$\times 1/[1/(1.6) + 0.04] =$	3.16		(27)
Walls	50.3	6.7	43.6	$\times 0.3 =$	13.08		(29)
Roof	47.2	0	47.2	$\times 0.25 =$	11.8		(30)
Total area of elements, m²			97.5				(31)
Party wall			19.8	$\times 0 =$	0		(32)
Party wall			16.8	$\times 0.2 =$	3.36		(32)

* 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) = 49.92 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 4717.2 (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 14.63 (36)

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

Total fabric heat loss (33) + (36) = 64.55 (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=	44.98	44.1	43.22	38.93	38.13	34.38	34.38	33.69	35.83	38.13	39.76	41.46

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

(39)m=	109.53	108.65	107.77	103.48	102.68	98.93	98.93	98.24	100.37	102.68	104.3	106.01
Average = Sum(39)...12 =												103.46 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$\{40\}m = \{39\}m + \{4\}$$

{40}m=	2.32	2.3	2.28	2.19	2.18	2.1	2.1	2.08	2.13	2.18	2.21	2.25		
	Average = Sum{40} / 12 =												2.19	{40}

Number of days in month (Table 1a)

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

4 Water heating energy requirement

Assumed occupancy, N

1.61

{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

72.39

{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=	79.63	76.74	73.84	70.94	68.05	65.15	65.15	68.05	70.94	73.84	76.74	79.63		
	Total = Sum{44} =												868.71	{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=	118.09	103.28	106.58	92.92	89.16	76.94	71.29	81.81	82.79	96.48	105.31	114.36		
	Total = Sum{45} =												1139.01	{45}

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

{46}m=	17.71	15.49	15.99	13.94	13.37	11.54	10.69	12.27	12.42	14.47	15.8	17.15		{46}
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Water storage loss:

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

200

{47}

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

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

Water storage loss:

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

2.24

{48}

Temperature factor from Table 2b

0.6

{49}

Energy lost from water storage, kWh/year

$$\{48\} \times \{49\} =$$

1.34

{50}

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

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

0

{51}

If community heating see section 4.3

Volume factor from Table 2a

0

{52}

Temperature factor from Table 2b

0

{53}

Energy lost from water storage, kWh/year

$$\{47\} \times \{51\} \times \{52\} \times \{53\} =$$

0

{54}

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

1.34

{55}

Water storage loss calculated for each month

$$\{56\}m = \{55\} \times \{41\}m$$

{56}m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{57}
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Primary circuit loss (annual) from Table 3

0

{58}

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

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

{59}m=	0	0	0	0	0	0	0	0	0	0	0	0		{59}
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SAP WorkSheet: New dwelling design stage

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	159.76	140.92	148.24	133.24	130.82	117.26	112.96	123.47	123.11	138.14	145.63	156.03	(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	(63)
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Output from water heater

(64)m=	159.76	140.92	148.24	133.24	130.82	117.26	112.96	123.47	123.11	138.14	145.63	156.03	
Output from water heater (annual): 1.12												1629.57	(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=	72.6	64.45	68.77	63.15	62.98	57.84	57.04	60.53	59.78	65.41	67.27	71.36	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	(66)

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

(67)m=	40.99	36.41	29.61	22.41	16.76	14.15	15.28	19.87	26.67	33.86	39.52	42.13	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	208.91	211.07	205.61	193.98	179.3	165.5	156.29	154.12	159.58	171.21	185.89	199.69	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	(71)
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Water heating gains (Table 5)

(72)m=	97.58	95.9	92.43	87.71	84.65	80.33	76.66	81.36	83.03	87.92	93.43	95.91	(72)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	425.89	421.8	406.07	382.53	359.12	338.4	326.65	333.77	347.7	371.41	397.26	416.15	(73)
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6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g _g Table 6b	FF Table 6c	Gains (W)	
Southwest 0.9x	0.77	2.1	36.79	0.63	0.7	23.61	(79)
Southwest 0.9x	0.77	2.1	62.67	0.63	0.7	40.22	(79)
Southwest 0.9x	0.77	2.1	85.75	0.63	0.7	55.03	(79)
Southwest 0.9x	0.77	2.1	106.25	0.63	0.7	68.19	(79)
Southwest 0.9x	0.77	2.1	119.01	0.63	0.7	76.38	(79)

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Southwest 0.9x	0.77	x	2.1	x	118.15	0.63	x	0.7	=	75.83	(79)
Southwest 0.9x	0.77	x	2.1	x	113.91	0.63	x	0.7	=	73.11	(79)
Southwest 0.9x	0.77	x	2.1	x	104.39	0.63	x	0.7	=	67	(79)
Southwest 0.9x	0.77	x	2.1	x	92.85	0.63	x	0.7	=	59.59	(79)
Southwest 0.9x	0.77	x	2.1	x	69.27	0.63	x	0.7	=	44.46	(79)
Southwest 0.9x	0.77	x	2.1	x	44.07	0.63	x	0.7	=	28.28	(79)
Southwest 0.9x	0.77	x	2.1	x	31.49	0.63	x	0.7	=	20.21	(79)
Northwest 0.9x	0.77	x	4.6	x	11.28	0.85	x	0.7	=	21.4	(81)
Northwest 0.9x	0.77	x	4.6	x	22.97	0.85	x	0.7	=	43.56	(81)
Northwest 0.9x	0.77	x	4.6	x	41.38	0.85	x	0.7	=	78.48	(81)
Northwest 0.9x	0.77	x	4.6	x	67.96	0.85	x	0.7	=	128.89	(81)
Northwest 0.9x	0.77	x	4.6	x	91.35	0.85	x	0.7	=	173.26	(81)
Northwest 0.9x	0.77	x	4.6	x	97.38	0.85	x	0.7	=	184.71	(81)
Northwest 0.9x	0.77	x	4.6	x	91.1	0.85	x	0.7	=	172.8	(81)
Northwest 0.9x	0.77	x	4.6	x	72.63	0.85	x	0.7	=	137.75	(81)
Northwest 0.9x	0.77	x	4.6	x	50.42	0.85	x	0.7	=	95.63	(81)
Northwest 0.9x	0.77	x	4.6	x	28.07	0.85	x	0.7	=	53.24	(81)
Northwest 0.9x	0.77	x	4.6	x	14.2	0.85	x	0.7	=	26.93	(81)
Northwest 0.9x	0.77	x	4.6	x	9.21	0.85	x	0.7	=	17.48	(81)

Solar gains in watts, calculated for each month

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

(83)m=	45.01	83.79	133.52	197.09	249.64	260.54	245.9	204.75	155.23	97.69	55.21	37.69	(83)
--------	-------	-------	--------	--------	--------	--------	-------	--------	--------	-------	-------	-------	------

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

(84)m=	470.9	505.59	539.59	579.61	608.76	598.94	572.55	538.52	502.92	469.1	452.48	453.83	(84)
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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)
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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=	0.99	0.98	0.97	0.95	0.89	0.78	0.65	0.69	0.87	0.96	0.98	0.99	(86)

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

(87)m=	18.76	18.94	19.29	19.83	20.31	20.72	20.89	20.87	20.57	19.96	19.32	18.79	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.13	19.14	19.15	19.21	19.22	19.27	19.27	19.28	19.25	19.22	19.2	19.17	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

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

(89)m=	0.98	0.98	0.96	0.93	0.84	0.66	0.44	0.49	0.77	0.93	0.97	0.98	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	16.34	16.6	17.11	17.91	18.58	19.1	19.24	19.23	18.93	18.12	17.19	16.4	(90)
--------	-------	------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =

0.44 (91)

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

(92)m=	17.41	17.64	18.08	18.76	19.35	19.82	19.97	19.96	19.65	18.93	18.13	17.46	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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(93)m=	17.41	17.64	18.08	18.76	19.35	19.82	19.97	19.96	19.65	18.93	18.13	17.46	(93)
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8. Space heating calculation

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

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

(94)m=	0.98	0.97	0.95	0.92	0.84	0.7	0.53	0.58	0.8	0.92	0.97	0.98	(94)
--------	------	------	------	------	------	-----	------	------	-----	------	------	------	------

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

(95)m=	459.55	489.84	514.52	531.84	513.84	421.01	306.13	313.17	401.45	433.82	436.87	444.08	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	1436.11	1383.9	1247.52	1020.12	785.04	516.12	333.54	349.42	557.52	855.7	1150.92	1405.67	(97)
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Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	726.56	600.81	545.35	351.56	201.77	0	0	0	0	313.88	514.12	715.42	
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Total per year ($kWh/year$) = $Sum(98)_{1..12} =$

3969.47 (98)

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

84.1 (99)

9. Space heating requirements: individual heating systems (including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

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

1 (202)

Fraction of total heating from main system 1

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

1 (204)

Efficiency of main space heating system 1

100 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

726.56	600.81	545.35	351.56	201.77	0	0	0	0	313.88	514.12	715.42
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

726.56	600.81	545.35	351.56	201.77	0	0	0	0	313.88	514.12	715.42
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Total ($kWh/year$) = $Sum(211)_{1..12} =$

3969.47 (211)

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

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

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

0 (215)

Water heating

Output from water heater (calculated above)

159.76	140.92	148.24	133.24	130.82	117.26	112.96	123.47	123.11	138.14	145.63	156.03
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Efficiency of water heater

100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100		(217)
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Fuel for water heating, $kWh/month$

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

(219)m=	159.76	140.92	148.24	133.24	130.82	117.26	112.96	123.47	123.11	138.14	145.63	156.03	
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Total = $Sum(219a)_{1..12} =$

1629.57 (219)

Annual totals

$kWh/year$

$kWh/year$

Space heating fuel used, main system 1

3969.47

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Water heating fuel used		1629.57	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0	(231)
Electricity for lighting		289.55	(232)

10a Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19	523.57 (240)
Space heating - main system 2	(213) x	0	0 (241)
Space heating - secondary	(215) x	13.19	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19	214.94 (245)
Low-rate cost	(219) x (244) x	13.19	0 (246)
Pumps, fans and electric keep-hot	(231)	13.19	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)	13.19	38.19 (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) =		776.71 (255)

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	3.54	(257)
SAP rating (Section 12)		50.6	(258)

12a CO2 emissions - individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	2060.15 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	845.75 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2905.9 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	0 (267)
Electricity for lighting	(232) x	0.519	150.28 (268)
Total CO2, kg/year		sum of (265)...(271) =	3056.18 (272)
CO2 emissions per m²		(272) ÷ (4) =	64.75 (273)

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El rating (section 14)

56

{274}

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	{211} x	3.07	=	12186.26	{261}
Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	5002.78	{264}
Space and water heating	{261} + {262} + {263} + {264} =			17189.04	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	0	{267}
Electricity for lighting	{232} x	0	=	888.93	{268}
'Total Primary Energy		sum of {265}...{271} =		18077.97	{272}
Primary energy kWh/m ² /year		{272} ÷ {4} =		383.01	{273}

SAP Input

Property Details: YC1001B

Address: Flat 1, 53 High Street, Bognor Regis, PO21 1RX
Located in: England
Region: South East England
UPRN:
Date of assessment: 05 March 2021
Date of certificate: 05 March 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/ person/ day: True
PCDF Version: 471

Property description

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 54.2 m² 2.7 m
Living area: 28.9 m² (fraction 0.533)
Front of dwelling faces: South West

Opening types

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (SE)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (SW)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	16mm or more mm	0.7	0.63	1.8	1.8	1
Windows (SE)	16mm or more	0.7	0.63	1.6	2.1	1
Windows (SW)	16mm or more	0.7	0.63	1.6	4.9	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall (external)	South West	0	0
Windows (SE)		Wall (external)	South East	0	0
Windows (SW)		Wall (external)	South West	0	0

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall (external)	52.5	8.8	43.7	0.3	0	False	N/A
Wall (retail)	43.4	0	43.4	0.7	0	False	N/A
Wall (retail) stud	9.1	0	9.1	0.28	0	False	N/A
Roof (flat)	2.9	0	2.9	0.25	0		N/A
Ground Floor	54.2			0.25			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							

Thermal Bridges

SAP Input

Thermal bridges: No information on thermal bridging (y= 0.15) (y = 0.15)

Ventilation:

Pressure test: No (Assumed)
 Ventilation: Natural ventilation (extract fans)
 Number of chimneys: 0
 Number of open flues: 0
 Number of fans: 2
 Number of passive stacks: 0
 Number of sides sheltered: 4
 Pressure test: 15

Main heating system:

Main heating system: Room heaters
 Electric (direct acting) room heaters
 Fuel: Electricity
 Info Source: SAP Tables
 SAP Table: 691
 Panel, convector or radiant heaters
 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature > 45°C
 Unknown
 Boiler interlock: Yes

Main heating Control:

Main heating Control: Programmer and appliance thermostats
 Control code: 2603

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
 Water code: 903
 Fuel :Electricity
 Hot water cylinder
 Cylinder volume: 200 litres
 Cylinder insulation: Measured loss, 2.24kWh/day
 Primary pipework insulation: False
 Cylinderstat: True
 Cylinder in heated space: True
 Immersion: Single
 Solar panel: False

Others:

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 75%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: None
 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: 4E1901B

Address : Flat 1, 53 High Street, Bognor Regis, PO21 1RX

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	54.2 (1a)	2.7 (2a)	146.34 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.2 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	146.34 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				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) =	0.14 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.89 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.62 (21)

Infiltration rate modified for monthly wind speed

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

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

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

0.79	0.78	0.76	0.68	0.67	0.59	0.59	0.57	0.62	0.67	0.7	0.73
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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= 0.81 0.8 0.79 0.73 0.72 0.67 0.67 0.66 0.69 0.72 0.74 0.77 (24d)

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

(25)m= 0.81 0.8 0.79 0.73 0.72 0.67 0.67 0.66 0.69 0.72 0.74 0.77 (25)

3. Heat losses and heat capacity parameter

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.8	1.8	3.24		(26)
Windows Type 1			2.1	$\times 1/[1/(1.6) + 0.04]$	3.16		(27)
Windows Type 2			4.9	$\times 1/[1/(1.6) + 0.04]$	7.37		(27)
Floor			54.2	0.25	13.55		(28)
Walls Type1	52.5	8.8	43.7	0.3	13.11		(29)
Walls Type2	43.4	0	43.4	0.7	30.38		(29)
Walls Type3	9.1	0	9.1	0.28	2.55		(29)
Roof	2.9	0	2.9	0.25	0.73		(30)
Total area of elements, m²			162.1				(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) = 74.08 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14754.8 (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 24.32 (36)

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

Total fabric heat loss (33) + (36) = 98.39 (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=	39.27	38.68	38.1	35.4	34.9	32.54	32.54	32.1	33.45	34.9	35.92	36.99

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

(39)m= 137.66 137.07 136.5 133.8 133.29 130.94 130.94 130.5 131.84 133.29 134.31 135.38 (39)

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Heat loss parameter (HLP), W/m²K

$$\{40\}m = \{39\}m + \{4\}$$

{40}m=	2.54	2.53	2.52	2.47	2.46	2.42	2.42	2.41	2.43	2.46	2.48	2.5		
Average = Sum{40} / 12 =													2.47	{40}

Number of days in month (Table 1a)

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

4 Water heating energy requirement

Assumed occupancy, N

1.81

{42}

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

if TFA ≤ 13.9, N = 1

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

77.28

{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=	85.01	81.92	78.83	75.73	72.64	69.55	69.55	72.64	75.73	78.83	81.92	85.01		
Total = Sum{44} =													927.36	{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=	126.06	110.26	113.77	99.19	95.18	82.13	76.11	87.33	88.38	102.99	112.42	122.09		
Total = Sum{45} =													1215.91	{45}

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

{46}m=	18.91	16.54	17.07	14.88	14.28	12.32	11.42	13.1	13.26	15.45	16.86	18.31		{46}
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	--	------

Water storage loss:

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

200

{47}

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

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

Water storage loss:

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

2.24

{48}

Temperature factor from Table 2b

0.6

{49}

Energy lost from water storage, kWh/year

$$\{48\} \times \{49\} =$$

1.34

{50}

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

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

0

{51}

If community heating see section 4.3

Volume factor from Table 2a

0

{52}

Temperature factor from Table 2b

0

{53}

Energy lost from water storage, kWh/year

$$\{47\} \times \{51\} \times \{52\} \times \{53\} =$$

0

{54}

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

1.34

{55}

Water storage loss calculated for each month

$$\{56\}m = \{55\} \times \{41\}m$$

{56}m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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 × (41)m

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

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

(62)m=	167.73	147.89	155.44	139.51	136.84	122.45	117.77	129	128.7	144.66	152.74	163.75	(62)
--------	--------	--------	--------	--------	--------	--------	--------	-----	-------	--------	--------	--------	------

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

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

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

Output from water heater

(64)m=	167.73	147.89	155.44	139.51	136.84	122.45	117.77	129	128.7	144.66	152.74	163.75	
Output from water heater (annual): 1.12												1706.47	(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=	75.25	66.77	71.16	65.24	64.98	59.56	58.64	62.37	61.64	67.58	69.64	73.92	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	(66)

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

(67)m=	47.95	42.59	34.64	26.22	19.6	16.55	17.88	23.24	31.19	39.61	46.23	49.28	(67)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(68)m=	236	238.45	232.28	219.14	202.56	186.97	176.56	174.11	180.28	193.42	210	225.59	(68)
--------	-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------	------

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

(69)m=	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	(69)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	101.14	99.35	95.65	90.61	87.34	82.73	78.81	83.83	85.61	90.83	96.72	99.36	(72)
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	469.07	464.37	446.54	419.95	393.47	370.22	357.22	365.15	381.06	407.83	436.92	458.21	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g _s Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.54	×	2.1	×	36.79	×	0.63	×	0.7	×	16.56	(77)
Southeast 0.9x	0.54	×	2.1	×	62.67	×	0.63	×	0.7	×	28.21	(77)
Southeast 0.9x	0.54	×	2.1	×	85.75	×	0.63	×	0.7	×	38.6	(77)
Southeast 0.9x	0.54	×	2.1	×	106.25	×	0.63	×	0.7	×	47.82	(77)
Southeast 0.9x	0.54	×	2.1	×	119.01	×	0.63	×	0.7	×	53.56	(77)

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Southeast 0.9x	0.54	x	2.1	x	118.15	x	0.63	x	0.7	=	53.18	(77)
Southeast 0.9x	0.54	x	2.1	x	113.91	x	0.63	x	0.7	=	51.27	(77)
Southeast 0.9x	0.54	x	2.1	x	104.39	x	0.63	x	0.7	=	46.98	(77)
Southeast 0.9x	0.54	x	2.1	x	92.85	x	0.63	x	0.7	=	41.79	(77)
Southeast 0.9x	0.54	x	2.1	x	69.27	x	0.63	x	0.7	=	31.18	(77)
Southeast 0.9x	0.54	x	2.1	x	44.07	x	0.63	x	0.7	=	19.84	(77)
Southeast 0.9x	0.54	x	2.1	x	31.49	x	0.63	x	0.7	=	14.17	(77)
Southwest 0.9x	0.54	x	4.9	x	36.79		0.63	x	0.7	=	38.64	(79)
Southwest 0.9x	0.54	x	4.9	x	62.67		0.63	x	0.7	=	65.82	(79)
Southwest 0.9x	0.54	x	4.9	x	85.75		0.63	x	0.7	=	90.06	(79)
Southwest 0.9x	0.54	x	4.9	x	106.25		0.63	x	0.7	=	111.59	(79)
Southwest 0.9x	0.54	x	4.9	x	119.01		0.63	x	0.7	=	124.98	(79)
Southwest 0.9x	0.54	x	4.9	x	118.15		0.63	x	0.7	=	124.08	(79)
Southwest 0.9x	0.54	x	4.9	x	113.91		0.63	x	0.7	=	119.63	(79)
Southwest 0.9x	0.54	x	4.9	x	104.39		0.63	x	0.7	=	109.63	(79)
Southwest 0.9x	0.54	x	4.9	x	92.85		0.63	x	0.7	=	97.51	(79)
Southwest 0.9x	0.54	x	4.9	x	69.27		0.63	x	0.7	=	72.74	(79)
Southwest 0.9x	0.54	x	4.9	x	44.07		0.63	x	0.7	=	46.28	(79)
Southwest 0.9x	0.54	x	4.9	x	31.49		0.63	x	0.7	=	33.07	(79)

Solar gains in watts, calculated for each month

$$(83)m = \text{Sum}(74)m \dots (82)m$$

(83)m=	55.2	94.03	128.65	159.41	178.55	177.26	170.9	156.62	139.3	103.92	66.12	47.24	(83)
--------	------	-------	--------	--------	--------	--------	-------	--------	-------	--------	-------	-------	------

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

(84)m=	524.27	558.4	575.19	579.35	572.02	547.48	528.12	521.77	520.37	511.75	503.04	505.45	(84)
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7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.98	0.97	0.94	0.88	0.78	0.79	0.9	0.96	0.98	0.99	(86)

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

(87)m=	18.54	18.71	19.04	19.52	20.02	20.5	20.77	20.74	20.38	19.75	19.09	18.53	(87)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19	19	19.01	19.04	19.04	19.07	19.07	19.08	19.06	19.04	19.03	19.02	(88)
--------	----	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.98	0.98	0.97	0.95	0.9	0.77	0.55	0.58	0.82	0.94	0.98	0.99	(89)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

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

(90)m=	15.94	16.19	16.67	17.39	18.09	18.73	19	18.98	18.59	17.72	16.76	15.95	(90)
--------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	------

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

0.53 (91)

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

(92)m=	17.33	17.53	17.93	18.52	19.12	19.67	19.94	19.92	19.55	18.8	18	17.33	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	----	-------	------

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

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(93)m=	17.33	17.53	17.93	18.52	19.12	19.67	19.94	19.92	19.55	18.8	18	17.33	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	----	-------	------

8. Space heating calculation

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

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

Utilisation factor for gains, h_m :

(94)m=	0.98	0.97	0.96	0.94	0.9	0.81	0.67	0.7	0.85	0.94	0.97	0.98	(94)
--------	------	------	------	------	-----	------	------	-----	------	------	------	------	------

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

(95)m=	512.63	542.82	553.35	545.77	515.5	444.32	354.33	363.01	441.8	479.56	487.37	495.36	(95)
--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1793.32	1731.46	1560.59	1287.73	988.85	664.14	437.41	459.19	718.34	1093.64	1464	1776.97	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	---------	------	---------	------

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

(98)m=	952.83	798.77	749.39	534.21	352.18	0	0	0	0	456.87	703.17	953.52	
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 5500.92 (98)

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

101.49 (99)

9. Space heating requirements - individual heating systems (including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

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

1 (202)

Fraction of total heating from main system 1

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

1 (204)

Efficiency of main space heating system 1

100 (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)

952.83	798.77	749.39	534.21	352.18	0	0	0	0	456.87	703.17	953.52
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

952.83	798.77	749.39	534.21	352.18	0	0	0	0	456.87	703.17	953.52
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total ($kWh/year$) = $Sum(211)_{1..12} =$ 5500.92 (211)

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

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

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

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

Water heating

Output from water heater (calculated above)

167.73	147.89	155.44	139.51	136.84	122.45	117.77	129	128.7	144.66	152.74	163.75
--------	--------	--------	--------	--------	--------	--------	-----	-------	--------	--------	--------

Efficiency of water heater

100 (216)

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

Fuel for water heating, $kWh/month$

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

(219)m=	167.73	147.89	155.44	139.51	136.84	122.45	117.77	129	128.7	144.66	152.74	163.75	
---------	--------	--------	--------	--------	--------	--------	--------	-----	-------	--------	--------	--------	--

Total = $Sum(219a)_{1..12} =$ 1706.47 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

5500.92

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Water heating fuel used		1706.47
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0 (231)
Electricity for lighting		338.72 (232)

10a Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19	725.57 (240)
Space heating - main system 2	(213) x	0	0 (241)
Space heating - secondary	(215) x	13.19	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	225.08 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Pumps, fans and electric keep-hot	(231)	13.19 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)	13.19 x 0.01 =	44.68 (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) =		995.33 (255)

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	4.21 (257)
SAP rating (Section 12)		41.41 (258)

12a CO2 emissions - individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	2854.98 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	885.66 (264)
Space and water heating	(261) + (262) + (263) + (264) =		3740.64 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	0 (267)
Electricity for lighting	(232) x	0.519	175.8 (268)
Total CO2, kg/year		sum of (265)...(271) =	3916.43 (272)
CO2 emissions per m²		(272) ÷ (4) =	72.26 (273)

SAP WorkSheet: New dwelling design stage

El rating (section 14)

48

{274}

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	{211} x	3.07	=	16887.84	{261}
Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	5238.87	{264}
Space and water heating	{261} + {262} + {263} + {264} =			22126.7	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	0	{267}
Electricity for lighting	{232} x	0	=	1039.88	{268}
'Total Primary Energy		sum of {265}...{271} =		23166.58	{272}
Primary energy kWh/m ² /year		{272} ÷ {4} =		427.43	{273}

SAP Input

Property Details: YC1 9Q2B

Address: Flat 2, 53 High Street, Bognor Regis, PO21 1RX
Located in: England
Region: South East England
UPRN:
Date of assessment: 05 March 2021
Date of certificate: 05 March 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/ person/ day: True
PCDF Version: 471

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 40.7 m² 3.1 m
Living area: 21.4 m² (fraction 0.526)
Front of dwelling faces: North East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Windows (NW)	SAP 2012	Windows	Single-glazed	No	Wood
Windows (SE)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Windows (NW)		0.7	0.85	4.8	5.1	1
Windows (SE)	16mm or more	0.7	0.63	1.6	2.1	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Windows (NW)		Wall (external)	North West	0	0
Windows (SE)		Wall (external)	South West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
Wall (external)	20.5	7.2	13.3	0.3	0	False	N/A
Wall (retail)	31.7	0	31.7	0.7	0	False	N/A
Floor Over Shop	36.1			0.25			N/A
Internal Elements							
Party Elements							
Party Wall	12.9						N/A
Party Wall	28.9						N/A

Thermal Bridging:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Ventilation:

Pressure test: No (Assumed)

SAP Input

Ventilation: Natural ventilation (extract fans)
 Number of chimneys: 0
 Number of open flues: 0
 Number of fans: 2
 Number of passive stacks: 0
 Number of sides sheltered: 3
 Pressure test: 15

Main heating system

Main heating system: Room heaters
 Electric (direct acting) room heaters
 Fuel: Electricity
 Info Source: SAP Tables
 SAP Table: 691
 Panel, convector or radiant heaters

 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature > 45°C
 Unknown
 Boiler interlock: Yes

Main heating Control

Main heating Control: Programmer and appliance thermostats
 Control code: 2603

Secondary heating system

Secondary heating system: None

Water heating

Water heating: Electric immersion (on-peak or off-peak)
 Water code: 903
 Fuel :Electricity
 Hot water cylinder
 Cylinder volume: 200 litres
 Cylinder insulation: Measured loss, 2.24kWh/day
 Primary pipework insulation: False
 Cylinderstat: True
 Cylinder in heated space: True
 Immersion: Single
 Solar panel: False

Others

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 75%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: None
 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: 4E1902B

Address : Flat 2, 53 High Street, Bognor Regis, PO21 1RX

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	40.7 (1a)	3.1 (2a)	126.17 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	40.7 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	126.17 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				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) =	0.16 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.91 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.7 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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SAP WorkSheet: New dwelling design stage

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

0.9	0.88	0.86	0.77	0.76	0.67	0.67	0.65	0.7	0.76	0.79	0.83
-----	------	------	------	------	------	------	------	-----	------	------	------

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= 0.9 0.89 0.87 0.8 0.79 0.72 0.72 0.71 0.75 0.79 0.81 0.84 (24d)

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

(25)m= 0.9 0.89 0.87 0.8 0.79 0.72 0.72 0.71 0.75 0.79 0.81 0.84 (25)

3. Heat losses and heat loss parameter

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			5.1	$\times 1/[1/(4.8) + 0.04] =$	20.54		(27)
Windows Type 2			2.1	$\times 1/[1/(1.6) + 0.04] =$	3.16		(27)
Floor			36.1	$\times$ 0.25	9.025		(28)
Walls Type1	20.5	7.2	13.3	$\times$ 0.3	3.99		(29)
Walls Type2	31.7	0	31.7	$\times$ 0.7	22.19		(29)
Total area of elements, m²			88.3				(31)
Party wall			12.9	$\times$ 0	0		(32)
Party wall			28.9	$\times$ 0.2	5.78		(32)

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

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

Fabric heat loss, W/K = S (A x U) (26) ... (30) + (32) = 64.68 (33)

Heat capacity Cm = S(A x k) ((23)...(30) + (32) + (32a)...(32e) = 9764.7 (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 13.25 (36)

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

Total fabric heat loss (33) + (36) = 77.92 (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=	37.6	36.94	36.31	33.31	32.74	30.13	30.13	29.65	31.14	32.74	33.88	35.07

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

(39)m= 115.52 114.87 114.23 111.23 110.67 108.06 108.06 107.57 109.06 110.67 111.8 112.99

Average = Sum(39) / 12 = 111.23 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$\{40\}m = \{39\}m + \{4\}$$

{40}m=	2.84	2.82	2.81	2.73	2.72	2.65	2.65	2.64	2.68	2.72	2.75	2.78		
Average = Sum{40} / 12 =													2.73	{40}

Number of days in month (Table 1a)

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

4 Water heating energy requirement

1st year

Assumed occupancy, N

1.43

{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

68.05

{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=	74.85	72.13	69.41	66.68	63.96	61.24	61.24	63.96	66.68	69.41	72.13	74.85		
Total = Sum{44} / 12 =													816.54	{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=	111	97.08	100.18	87.34	83.8	72.32	67.01	76.9	77.82	90.69	98.99	107.5		
Total = Sum{45} / 12 =													1070.62	{45}

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

{46}m=	16.65	14.56	15.03	13.1	12.57	10.85	10.05	11.53	11.67	13.6	14.85	16.12		{46}
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Water storage loss:

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

200

{47}

If community heating and no tank in dwelling, enter 110 litres in {47}

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

Water storage loss:

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

2.24

{48}

Temperature factor from Table 2b

0.6

{49}

Energy lost from water storage, kWh/year

$$\{48\} \times \{49\} =$$

1.34

{50}

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

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

0

{51}

If community heating see section 4.3

Volume factor from Table 2a

0

{52}

Temperature factor from Table 2b

0

{53}

Energy lost from water storage, kWh/year

$$\{47\} \times \{51\} \times \{52\} \times \{53\} =$$

0

{54}

Enter {50} or {54} in {55}

1.34

{55}

Water storage loss calculated for each month

$$\{56\}m = \{55\} \times \{41\}m$$

{56}m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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}
--------	---	---	---	---	---	---	---	---	---	---	---	---	--	------

SAP WorkSheet: New dwelling design stage

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

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

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

(62)m=	152.66	134.71	141.84	127.66	125.47	112.64	108.68	118.56	118.14	132.35	139.31	149.16	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

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

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

Output from water heater

(64)m=	152.66	134.71	141.84	127.66	125.47	112.64	108.68	118.56	118.14	132.35	139.31	149.16	
Output from water heater (annual): 1.12												1561.18	(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=	70.24	62.39	66.64	61.3	61.2	56.3	55.61	58.9	58.13	63.48	65.17	69.07	(65)
--------	-------	-------	-------	------	------	------	-------	------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	(66)

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

(67)m=	35	31.09	25.28	19.14	14.31	12.08	13.05	16.97	22.77	28.92	33.75	35.98	(67)
--------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(68)m=	184.03	185.94	181.12	170.88	157.95	145.79	137.67	135.76	140.58	150.82	163.75	175.91	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-57	-57	-57	-57	-57	-57	-57	-57	-57	-57	-57	-57	(71)
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

Water heating gains (Table 5)

(72)m=	94.41	92.84	89.57	85.13	82.25	78.2	74.75	79.17	80.74	85.33	90.51	92.84	(72)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	386.91	383.34	369.46	348.63	327.99	309.55	298.95	305.37	317.56	338.54	361.49	378.2	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g _g Table 6b		FF Table 6c		Gains (W)	
Southwest 0.9x	0.54	×	2.1	×	36.79		0.63	×	0.7	≈	16.56	(79)
Southwest 0.9x	0.54	×	2.1	×	62.67		0.63	×	0.7	≈	28.21	(79)
Southwest 0.9x	0.54	×	2.1	×	85.75		0.63	×	0.7	≈	38.6	(79)
Southwest 0.9x	0.54	×	2.1	×	106.25		0.63	×	0.7	≈	47.82	(79)
Southwest 0.9x	0.54	×	2.1	×	119.01		0.63	×	0.7	≈	53.56	(79)

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Southwest 0.9x	0.54	x	2.1	x	118.15	0.63	x	0.7	=	53.18	(79)
Southwest 0.9x	0.54	x	2.1	x	113.91	0.63	x	0.7	=	51.27	(79)
Southwest 0.9x	0.54	x	2.1	x	104.39	0.63	x	0.7	=	46.98	(79)
Southwest 0.9x	0.54	x	2.1	x	92.85	0.63	x	0.7	=	41.79	(79)
Southwest 0.9x	0.54	x	2.1	x	69.27	0.63	x	0.7	=	31.18	(79)
Southwest 0.9x	0.54	x	2.1	x	44.07	0.63	x	0.7	=	19.84	(79)
Southwest 0.9x	0.54	x	2.1	x	31.49	0.63	x	0.7	=	14.17	(79)
Northwest 0.9x	0.77	x	5.1	x	11.28	0.85	x	0.7	=	23.73	(81)
Northwest 0.9x	0.77	x	5.1	x	22.97	0.85	x	0.7	=	48.3	(81)
Northwest 0.9x	0.77	x	5.1	x	41.38	0.85	x	0.7	=	87.02	(81)
Northwest 0.9x	0.77	x	5.1	x	67.96	0.85	x	0.7	=	142.9	(81)
Northwest 0.9x	0.77	x	5.1	x	91.35	0.85	x	0.7	=	192.09	(81)
Northwest 0.9x	0.77	x	5.1	x	97.38	0.85	x	0.7	=	204.79	(81)
Northwest 0.9x	0.77	x	5.1	x	91.1	0.85	x	0.7	=	191.58	(81)
Northwest 0.9x	0.77	x	5.1	x	72.63	0.85	x	0.7	=	152.73	(81)
Northwest 0.9x	0.77	x	5.1	x	50.42	0.85	x	0.7	=	106.03	(81)
Northwest 0.9x	0.77	x	5.1	x	28.07	0.85	x	0.7	=	59.02	(81)
Northwest 0.9x	0.77	x	5.1	x	14.2	0.85	x	0.7	=	29.85	(81)
Northwest 0.9x	0.77	x	5.1	x	9.21	0.85	x	0.7	=	19.38	(81)

Solar gains in watts, calculated for each month

$$(83)m = \text{Sum}(74)m \dots (82)m$$

(83)m=	40.29	76.51	125.61	190.73	245.66	257.97	242.85	199.71	147.82	90.2	49.69	33.55	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	------	-------	-------	------

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

(84)m=	427.2	459.84	495.07	539.36	573.64	567.51	541.8	505.09	465.38	428.74	411.18	411.75	(84)
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.95	0.9	0.8	0.68	0.73	0.88	0.96	0.98	0.99	(86)

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

(87)m=	18.34	18.53	18.92	19.5	20.08	20.57	20.81	20.77	20.38	19.67	18.94	18.34	(87)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	18.83	18.84	18.85	18.89	18.9	18.93	18.93	18.94	18.92	18.9	18.88	18.87	(88)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	------

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

(89)m=	0.98	0.97	0.96	0.92	0.84	0.66	0.43	0.49	0.77	0.93	0.97	0.98	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	15.58	15.85	16.42	17.28	18.06	18.68	18.89	18.87	18.48	17.53	16.48	15.6	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

0.53 (91)

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

(92)m=	17.03	17.26	17.73	18.45	19.12	19.68	19.9	19.87	19.48	18.65	17.77	17.04	(92)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

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(93)m=	17.03	17.26	17.73	18.45	19.12	19.68	19.9	19.87	19.48	18.65	17.77	17.04	(93)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

8. Space heating calculation

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

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

Utilisation factor for gains, h_m :

(94)m=	0.97	0.96	0.95	0.91	0.84	0.72	0.57	0.62	0.81	0.92	0.96	0.97	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	415.34	443.73	469.9	492.77	484.47	408.74	307.52	310.69	376.92	395.76	395.45	401.41	(95)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1470.33	1419.6	1283.05	1062.1	821.41	548.42	356.31	373.07	586.66	891.38	1193.27	1451.07	(97)
--------	---------	--------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	784.91	655.78	604.98	409.91	250.69	0	0	0	0	368.74	574.43	780.95	
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	--

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

4430.39 (98)

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

108.85 (99)

9. Space heating requirements - individual heating systems (including micro CHP)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

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

1 (202)

Fraction of total heating from main system 1

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

1 (204)

Efficiency of main space heating system 1

100 (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)

784.91	655.78	604.98	409.91	250.69	0	0	0	0	368.74	574.43	780.95
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

784.91	655.78	604.98	409.91	250.69	0	0	0	0	368.74	574.43	780.95
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

4430.39 (211)

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

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

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

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

0 (215)

Water heating

Output from water heater (calculated above)

152.66	134.71	141.84	127.66	125.47	112.64	108.68	118.56	118.14	132.35	139.31	149.16
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

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

Fuel for water heating, $kWh/month$

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

(219)m=	152.66	134.71	141.84	127.66	125.47	112.64	108.68	118.56	118.14	132.35	139.31	149.16	
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

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

1561.18 (219)

Annual totals

$kWh/year$

$kWh/year$

Space heating fuel used, main system 1

4430.39

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Water heating fuel used		1561.18	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0	(231)
Electricity for lighting		247.28	(232)

10a Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =	584.37 (240)
Space heating - main system 2	(213) x	0	x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0 (242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1	(243)
Low-rate fraction	1.0 - (243) =		0	(244)
High-rate cost	(219) x (243) x	13.19	x 0.01 =	205.92 (245)
Low-rate cost	(219) x (244) x	13.19	x 0.01 =	0 (246)
Pumps, fans and electric keep-hot	(231)	13.19	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)	13.19	x 0.01 =	32.62 (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) =			822.9 (255)

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	4.03	(257)
SAP rating (Section 12)		43.72	(258)

12a CO2 emissions - individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	2299.37 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.519	=	810.25 (264)
Space and water heating	(261) + (262) + (263) + (264) =			3109.62 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0 (267)
Electricity for lighting	(232) x	0.519	=	128.34 (268)
Total CO2, kg/year			sum of (265)...(271) =	3237.96 (272)
CO2 emissions per m²			(272) ÷ (4) =	79.56 (273)

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El rating (section 14)

50

{274}

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	{211} x	3.07	=	13601.3	{261}
Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	4792.81	{264}
Space and water heating	{261} + {262} + {263} + {264} =			18394.11	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	0	{267}
Electricity for lighting	{232} x	0	=	759.14	{268}
'Total Primary Energy		sum of {265}...{271} =		19153.25	{272}
Primary energy kWh/m ² /year		{272} ÷ {4} =		470.6	{273}

SAP Input

Property Details: YC1 9Q3B

Address: Flat 3, 53 High Street, Bognor Regis, PO21 1RX
Located in: England
Region: South East England
UPRN:
Date of assessment: 05 March 2021
Date of certificate: 05 March 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/ person/ day: True
PCDF Version: 471

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 51.1 m² 2.6 m
Living area: 22.4 m² (fraction 0.438)
Front of dwelling faces: North West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Windows (SE)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (SW)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Windows (SE)	16mm or more	0.7	0.63	1.6	2.9	1
Windows (SW)	16mm or more	0.7	0.63	1.6	5.6	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Windows (SE)		Wall (external)	South East	0	0
Windows (SW)		Wall (external)	South West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall (external)	48.1	8.5	39.6	0.3	0	False	N/A
Roof	51.1	0	51.1	0.25	0		N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
Party Wall	39.3						N/A
Party Wall	8.8						N/A

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Ventilation:

Pressure test: No (Assumed)

SAP Input

Ventilation: Natural ventilation (extract fans)
 Number of chimneys: 0
 Number of open flues: 0
 Number of fans: 2
 Number of passive stacks: 0
 Number of sides sheltered: 3
 Pressure test: 15

Main heating system

Main heating system: Room heaters
 Electric (direct acting) room heaters
 Fuel: Electricity
 Info Source: SAP Tables
 SAP Table: 691
 Panel, convector or radiant heaters

 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature > 45°C
 Unknown
 Boiler interlock: Yes

Main heating Control

Main heating Control: Programmer and appliance thermostats
 Control code: 2603

Secondary heating system

Secondary heating system: None

Water heating

Water heating: Electric immersion (on-peak or off-peak)
 Water code: 903
 Fuel :Electricity
 Hot water cylinder
 Cylinder volume: 200 litres
 Cylinder insulation: Measured loss, 2.24kWh/day
 Primary pipework insulation: False
 Cylinderstat: True
 Cylinder in heated space: True
 Immersion: Single
 Solar panel: False

Others

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 75%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: Photovoltaic 1
 Installed Peak power: 3.23
 Tilt of collector: 30°
 Overshading: None or very little
 Collector Orientation: South East

 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: 4E1903B

Address : Flat 3, 53 High Street, Bognor Regis, PO21 1RX

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.1 (1a)	2.6 (2a)	132.86 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.1 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	132.86 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				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) =	0.15 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.9 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.7 (21)
Infiltration rate modified for monthly wind speed			

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

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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SAP WorkSheet: New dwelling design stage

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

0.89	0.87	0.85	0.77	0.75	0.66	0.66	0.65	0.7	0.75	0.79	0.82
------	------	------	------	------	------	------	------	-----	------	------	------

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)m x 0.5]

(24d)m= 0.9 0.88 0.87 0.79 0.78 0.72 0.72 0.71 0.74 0.78 0.81 0.84 (24d)

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

(25)m= 0.9 0.88 0.87 0.79 0.78 0.72 0.72 0.71 0.74 0.78 0.81 0.84 (25)

3. Heat losses and heat capacity parameter

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			2.9	x1/[1/(1.6)+0.04] =	4.36		(27)
Windows Type 2			5.6	x1/[1/(1.6)+0.04] =	8.42		(27)
Walls	48.1	8.5	39.6	x 0.3 =	11.88		(29)
Roof	51.1	0	51.1	x 0.25 =	12.77		(30)
Total area of elements, m ²			99.2				(31)
Party wall			39.3	x 0 =	0		(32)
Party wall			8.8	x 0.2 =	1.76		(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 39.2 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 8066.3 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 14.88 (36)

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

Total fabric heat loss (33) + (36) = 54.08 (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=	39.28	38.61	37.95	34.84	34.26	31.56	31.56	31.06	32.6	34.26	35.44	36.66

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

(39)m=	93.36	92.68	92.02	88.92	88.34	85.64	85.64	85.14	86.68	88.34	89.51	90.74
Average = Sum(39)...12/12=												88.92 (39)

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Heat loss parameter (HLP), W/m²K

$$\{40\}m = \{39\}m + \{4\}$$

{40}m=	1.83	1.81	1.8	1.74	1.73	1.68	1.68	1.67	1.7	1.73	1.75	1.78		
Average = Sum{40} / 12 =													1.74	{40}

Number of days in month (Table 1a)

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

4 Water heating energy requirement

1st year

Assumed occupancy, N

1.72

{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

75.11

{43}

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

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

{44}m=	82.62	79.62	76.61	73.61	70.6	67.6	67.6	70.6	73.61	76.61	79.62	82.62		
Total = Sum{44} =													901.32	{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=	122.52	107.16	110.58	96.41	92.5	79.82	73.97	84.88	85.89	100.1	109.27	118.66		
Total = Sum{45} =													1181.77	{45}

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

{46}m=	18.38	16.07	16.59	14.46	13.88	11.97	11.1	12.73	12.88	15.02	16.39	17.8		{46}
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Water storage loss:

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

200

{47}

If community heating and no tank in dwelling, enter 110 litres in {47}

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

Water storage loss:

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

2.24

{48}

Temperature factor from Table 2b

0.6

{49}

Energy lost from water storage, kWh/year

$$\{48\} \times \{49\} =$$

1.34

{50}

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

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

0

{51}

If community heating see section 4.3

Volume factor from Table 2a

0

{52}

Temperature factor from Table 2b

0

{53}

Energy lost from water storage, kWh/year

$$\{47\} \times \{51\} \times \{52\} \times \{53\} =$$

0

{54}

Enter {50} or {54} in {55}

1.34

{55}

Water storage loss calculated for each month

$$\{56\}m = \{55\} \times \{41\}m$$

{56}m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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}
--------	---	---	---	---	---	---	---	---	---	---	---	---	--	------

SAP WorkSheet: New dwelling design stage

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

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

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

(62)m=	164.19	144.79	152.24	136.73	134.17	120.14	115.63	126.54	126.21	141.77	149.59	160.32	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

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

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

Output from water heater

(64)m=	164.19	144.79	152.24	136.73	134.17	120.14	115.63	126.54	126.21	141.77	149.59	160.32	
Output from water heater (annual): 1.12												1672.33	(64)

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

(65)m=	74.07	65.74	70.1	64.31	64.09	58.8	57.93	61.55	60.82	66.61	68.59	72.79	(65)
--------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	(66)

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

(67)m=	44.51	39.53	32.15	24.34	18.19	15.36	16.6	21.57	28.95	36.76	42.91	45.74	(67)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(68)m=	224.02	226.34	220.48	208.01	192.27	177.47	167.59	165.27	171.12	183.59	199.34	214.13	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	(71)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water heating gains (Table 5)

(72)m=	99.56	97.82	94.22	89.32	86.14	81.66	77.86	82.73	84.47	89.54	95.26	97.83	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains =

(73)m=	449.59	445.2	428.36	403.18	378.11	356	343.55	351.08	366.05	391.4	419.01	439.21	(73)
--------	--------	-------	--------	--------	--------	-----	--------	--------	--------	-------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g _g Table 6b	FF Table 6c	Gains (W)	
Southeast 0.9x	0.77	2.9	36.79	0.63	0.7	32.61	(77)
Southeast 0.9x	0.77	2.9	62.67	0.63	0.7	55.55	(77)
Southeast 0.9x	0.77	2.9	85.75	0.63	0.7	76	(77)
Southeast 0.9x	0.77	2.9	106.25	0.63	0.7	94.17	(77)
Southeast 0.9x	0.77	2.9	119.01	0.63	0.7	105.48	(77)

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Southeast 0.9x	0.77	x	2.9	x	118.15	x	0.63	x	0.7	=	104.71	(77)
Southeast 0.9x	0.77	x	2.9	x	113.91	x	0.63	x	0.7	=	100.96	(77)
Southeast 0.9x	0.77	x	2.9	x	104.39	x	0.63	x	0.7	=	92.52	(77)
Southeast 0.9x	0.77	x	2.9	x	92.85	x	0.63	x	0.7	=	82.29	(77)
Southeast 0.9x	0.77	x	2.9	x	69.27	x	0.63	x	0.7	=	61.39	(77)
Southeast 0.9x	0.77	x	2.9	x	44.07	x	0.63	x	0.7	=	39.06	(77)
Southeast 0.9x	0.77	x	2.9	x	31.49	x	0.63	x	0.7	=	27.91	(77)
Southwest 0.9x	0.54	x	5.6	x	36.79		0.63	x	0.7	=	44.16	(79)
Southwest 0.9x	0.54	x	5.6	x	62.67		0.63	x	0.7	=	75.22	(79)
Southwest 0.9x	0.54	x	5.6	x	85.75		0.63	x	0.7	=	102.92	(79)
Southwest 0.9x	0.54	x	5.6	x	106.25		0.63	x	0.7	=	127.53	(79)
Southwest 0.9x	0.54	x	5.6	x	119.01		0.63	x	0.7	=	142.84	(79)
Southwest 0.9x	0.54	x	5.6	x	118.15		0.63	x	0.7	=	141.81	(79)
Southwest 0.9x	0.54	x	5.6	x	113.91		0.63	x	0.7	=	136.72	(79)
Southwest 0.9x	0.54	x	5.6	x	104.39		0.63	x	0.7	=	125.29	(79)
Southwest 0.9x	0.54	x	5.6	x	92.85		0.63	x	0.7	=	111.44	(79)
Southwest 0.9x	0.54	x	5.6	x	69.27		0.63	x	0.7	=	83.14	(79)
Southwest 0.9x	0.54	x	5.6	x	44.07		0.63	x	0.7	=	52.89	(79)
Southwest 0.9x	0.54	x	5.6	x	31.49		0.63	x	0.7	=	37.79	(79)

Solar gains in watts, calculated for each month

$$(83)m = \text{Sum}(74)m \dots (82)m$$

(83)m=	76.77	130.77	178.92	221.69	248.32	246.52	237.67	217.81	193.74	144.53	91.95	65.7	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------	------

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

(84)m=	526.36	575.97	607.28	624.87	626.43	602.53	581.22	568.89	559.79	535.93	510.97	504.91	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.94	0.88	0.75	0.6	0.63	0.81	0.94	0.98	0.99	(86)

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

(87)m=	19.3	19.48	19.77	20.19	20.55	20.84	20.95	20.94	20.76	20.31	19.77	19.31	(87)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.45	19.46	19.47	19.51	19.52	19.56	19.56	19.57	19.54	19.52	19.5	19.49	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

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

(89)m=	0.98	0.97	0.95	0.91	0.82	0.64	0.42	0.46	0.72	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=	17.3	17.56	17.99	18.6	19.09	19.46	19.54	19.54	19.37	18.79	18.01	17.33	(90)
--------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

0.44

(91)

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

(92)m=	18.18	18.4	18.77	19.3	19.73	20.06	20.16	20.16	19.98	19.45	18.78	18.2	(92)
--------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	------

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

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(93)m=	18.18	18.4	18.77	19.3	19.73	20.06	20.16	20.16	19.98	19.45	18.78	18.2	(93)
--------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	------

8. Space heating calculation

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

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

Utilisation factor for gains, h_m :

(94)m=	0.97	0.96	0.95	0.91	0.83	0.68	0.5	0.53	0.75	0.91	0.96	0.98	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

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

(95)m=	513.17	555.64	574.73	567.34	521.34	410.18	291.42	302.8	419.91	485.27	491	493.84	(95)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-----	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1295.33	1251.46	1129.28	924.59	709.47	467.81	304.82	319.76	509.69	782.04	1045.44	1270.33	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	581.92	467.59	412.58	257.22	139.97	0	0	0	0	220.8	399.2	577.7	
--------	--------	--------	--------	--------	--------	---	---	---	---	-------	-------	-------	--

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

3056.99 (98)

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

59.82 (99)

9. Space heating requirements - individual heating systems (including micro CHP)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

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

1 (202)

Fraction of total heating from main system 1

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

1 (204)

Efficiency of main space heating system 1

100 (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)

581.92	467.59	412.58	257.22	139.97	0	0	0	0	220.8	399.2	577.7
--------	--------	--------	--------	--------	---	---	---	---	-------	-------	-------

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

581.92	467.59	412.58	257.22	139.97	0	0	0	0	220.8	399.2	577.7
--------	--------	--------	--------	--------	---	---	---	---	-------	-------	-------

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

3056.99 (211)

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

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

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

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

0 (215)

Water heating

Output from water heater (calculated above)

164.19	144.79	152.24	136.73	134.17	120.14	115.63	126.54	126.21	141.77	149.59	160.32
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

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

Fuel for water heating, $kWh/month$

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

(219)m=	164.19	144.79	152.24	136.73	134.17	120.14	115.63	126.54	126.21	141.77	149.59	160.32	
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

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

1672.33 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3056.99

SAP WorkSheet: New dwelling design stage

Water heating fuel used		1672.33	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0	(231)
Electricity for lighting		314.4	(232)
Electricity generated by PVs		-2659.42	(233)

10a Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =	403.22 (240)
Space heating - main system 2	(213) x	0	x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0 (242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1	(243)
Low-rate fraction	1.0 - (243) =		0	(244)
High-rate cost	(219) x (243) x	13.19	x 0.01 =	220.58 (245)
Low-rate cost	(219) x (244) x	13.19	x 0.01 =	0 (246)
Pumps, fans and electric keep-hot	(231)	13.19	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)	13.19	x 0.01 =	41.47 (250)
Additional standing charges (Table 12)				0 (251)
	one of (233) to (235) x	13.19	x 0.01 =	-350.78 (252)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =			314.49 (255)

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.37	(257)
SAP rating (Section 12)		80.83	(258)

12a CO2 emissions - individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	1586.58 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.519	=	867.94 (264)
Space and water heating	(261) + (262) + (263) + (264) =			2454.52 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0 (267)
Electricity for lighting	(232) x	0.519	=	163.17 (268)

SAP WorkSheet: New dwelling design stage

Energy saving/generation technologies

Item 1	0.519	=	-1380.24	(269)
Total CO ₂ , kg/year	sum of (265)...(271) =			1237.45 (272)
CO₂ emissions per m²	(272) ÷ (4) =			24.22 (273)
El rating (section 14)				83 (274)

12a Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year
Space heating (main system 1)	(211) x	3.07	=	9384.95 (261)
Space heating (secondary)	(215) x	3.07	=	0 (263)
Energy for water heating	(219) x	3.07	=	5134.05 (264)
Space and water heating	(261) + (262) + (263) + (264) =			14519 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	0 (267)
Electricity for lighting	(232) x	0	=	965.21 (268)
Energy saving/generation technologies				
Item 1		3.07	=	-8164.41 (269)
'Total Primary Energy	sum of (265)...(271) =			7319.8 (272)
Primary energy kWh/m²/year	(272) ÷ (4) =			143.24 (273)

SAP Input

Property Details: YC1904B

Address: Flat 4, 53 High Street, Bognor Regis, PO21 1RX
Located in: England
Region: South East England
UPRN:
Date of assessment: 05 March 2021
Date of certificate: 05 March 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/ person/ day: True
PCDF Version: 471

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 47.2 m² 2.7 m
Living area: 20.9 m² (fraction 0.443)
Front of dwelling faces: South East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Windows (NW)	SAP 2012	Windows	Single-glazed	No	Wood
Windows (SE)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Windows (NW)		0.7	0.85	4.8	4.6	1
Windows (SE)	16mm or more	0.7	0.63	1.6	2.1	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Windows (NW)		Wall (external)	North West	0	0
Windows (SE)		Wall (external)	South West	0	0

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall (external)	50.3	6.7	43.6	0.3	0	False	N/A
Roof	47.2	0	47.2	0.25	0		N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
Party Wall	19.8						N/A
Party Wall	16.8						N/A

Thermal Bridges

Thermal bridges: No information on thermal bridging (y=0.15) (y=0.15)

Ventilation

Pressure test: No (Assumed)

SAP Input

Ventilation: Natural ventilation (extract fans)
 Number of chimneys: 0
 Number of open flues: 0
 Number of fans: 2
 Number of passive stacks: 0
 Number of sides sheltered: 1
 Pressure test: 15

Main heating system

Main heating system: Room heaters
 Electric (direct acting) room heaters
 Fuel: Electricity
 Info Source: SAP Tables
 SAP Table: 691
 Panel, convector or radiant heaters

 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature > 45°C
 Unknown
 Boiler interlock: Yes

Main heating Control

Main heating Control: Programmer and appliance thermostats
 Control code: 2603

Secondary heating system

Secondary heating system: None

Water heating

Water heating: Electric immersion (on-peak or off-peak)
 Water code: 903
 Fuel :Electricity
 Hot water cylinder
 Cylinder volume: 200 litres
 Cylinder insulation: Measured loss, 2.24kWh/day
 Primary pipework insulation: False
 Cylinderstat: True
 Cylinder in heated space: True
 Immersion: Single
 Solar panel: False

Others

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 75%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: None
 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: 4E1904B

Address : Flat 4, 53 High Street, Bognor Regis, PO21 1RX

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	47.2 (1a)	2.7 (2a)	127.44 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	47.2 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	127.44 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				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) =	0.16 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.91 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.84 (21)

Infiltration rate modified for monthly wind speed

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

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

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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SAP WorkSheet: New dwelling design stage

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

1.07	1.05	1.03	0.92	0.9	0.8	0.8	0.78	0.84	0.9	0.94	0.99
------	------	------	------	-----	-----	-----	------	------	-----	------	------

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 1.05 1.03 0.93 0.91 0.82 0.82 0.8 0.85 0.91 0.95 0.99 (24d)

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

(25)m= 1.07 1.05 1.03 0.93 0.91 0.82 0.82 0.8 0.85 0.91 0.95 0.99 (25)

3. Heat losses and heat capacity parameter

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			4.6	$\times 1/[1/(4.8) + 0.04] =$	18.52		(27)
Windows Type 2			2.1	$\times 1/[1/(1.6) + 0.04] =$	3.16		(27)
Walls	50.3	6.7	43.6	$\times$ 0.3	13.08		(29)
Roof	47.2	0	47.2	$\times$ 0.25	11.8		(30)
Total area of elements, m²			97.5				(31)
Party wall			19.8	$\times$ 0	0		(32)
Party wall			16.8	$\times$ 0.2	3.36		(32)

* 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) = 49.92 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 4717.2 (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 14.63 (36)

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

Total fabric heat loss (33) + (36) = 64.55 (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=	44.98	44.1	43.22	38.93	38.13	34.38	34.38	33.69	35.83	38.13	39.76	41.46

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

(39)m=	109.53	108.65	107.77	103.48	102.68	98.93	98.93	98.24	100.37	102.68	104.3	106.01
Average = Sum(39)...12 =												103.46

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$\{40\}m = \{39\}m + \{4\}$$

{40}m=	2.32	2.3	2.28	2.19	2.18	2.1	2.1	2.08	2.13	2.18	2.21	2.25		
	Average = Sum{40} / 12 =												2.19	{40}

Number of days in month (Table 1a)

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

4 Water heating energy requirement

Assumed occupancy, N

1.61

{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

72.39

{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=	79.63	76.74	73.84	70.94	68.05	65.15	65.15	68.05	70.94	73.84	76.74	79.63		
	Total = Sum{44} =												868.71	{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=	118.09	103.28	106.58	92.92	89.16	76.94	71.29	81.81	82.79	96.48	105.31	114.36		
	Total = Sum{45} =												1139.01	{45}

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

{46}m=	17.71	15.49	15.99	13.94	13.37	11.54	10.69	12.27	12.42	14.47	15.8	17.15		{46}
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Water storage loss:

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

200

{47}

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

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

Water storage loss:

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

2.24

{48}

Temperature factor from Table 2b

0.6

{49}

Energy lost from water storage, kWh/year

$$\{48\} \times \{49\} =$$

1.34

{50}

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

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

0

{51}

If community heating see section 4.3

Volume factor from Table 2a

0

{52}

Temperature factor from Table 2b

0

{53}

Energy lost from water storage, kWh/year

$$\{47\} \times \{51\} \times \{52\} \times \{53\} =$$

0

{54}

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

1.34

{55}

Water storage loss calculated for each month

$$\{56\}m = \{55\} \times \{41\}m$$

{56}m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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 × (41)m

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

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

(62)m=	159.76	140.92	148.24	133.24	130.82	117.26	112.96	123.47	123.11	138.14	145.63	156.03	(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	(63)
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Output from water heater

(64)m=	159.76	140.92	148.24	133.24	130.82	117.26	112.96	123.47	123.11	138.14	145.63	156.03	
Output from water heater (annual): 1.12												1629.57	(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=	72.6	64.45	68.77	63.15	62.98	57.84	57.04	60.53	59.78	65.41	67.27	71.36	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	(66)

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

(67)m=	40.99	36.41	29.61	22.41	16.76	14.15	15.28	19.87	26.67	33.86	39.52	42.13	(67)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(68)m=	208.91	211.07	205.61	193.98	179.3	165.5	156.29	154.12	159.58	171.21	185.89	199.69	(68)
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	97.58	95.9	92.43	87.71	84.65	80.33	76.66	81.36	83.03	87.92	93.43	95.91	(72)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	425.89	421.8	406.07	382.53	359.12	338.4	326.65	333.77	347.7	371.41	397.26	416.15	(73)
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6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g _g Table 6b	FF Table 6c	Gains (W)	
Southwest 0.9x	0.77	2.1	36.79	0.63	0.7	23.61	(79)
Southwest 0.9x	0.77	2.1	62.67	0.63	0.7	40.22	(79)
Southwest 0.9x	0.77	2.1	85.75	0.63	0.7	55.03	(79)
Southwest 0.9x	0.77	2.1	106.25	0.63	0.7	68.19	(79)
Southwest 0.9x	0.77	2.1	119.01	0.63	0.7	76.38	(79)

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Southwest 0.9x	0.77	x	2.1	x	118.15		0.63	x	0.7	=	75.83	(79)
Southwest 0.9x	0.77	x	2.1	x	113.91		0.63	x	0.7	=	73.11	(79)
Southwest 0.9x	0.77	x	2.1	x	104.39		0.63	x	0.7	=	67	(79)
Southwest 0.9x	0.77	x	2.1	x	92.85		0.63	x	0.7	=	59.59	(79)
Southwest 0.9x	0.77	x	2.1	x	69.27		0.63	x	0.7	=	44.46	(79)
Southwest 0.9x	0.77	x	2.1	x	44.07		0.63	x	0.7	=	28.28	(79)
Southwest 0.9x	0.77	x	2.1	x	31.49		0.63	x	0.7	=	20.21	(79)
Northwest 0.9x	0.77	x	4.6	x	11.28	x	0.85	x	0.7	=	21.4	(81)
Northwest 0.9x	0.77	x	4.6	x	22.97	x	0.85	x	0.7	=	43.56	(81)
Northwest 0.9x	0.77	x	4.6	x	41.38	x	0.85	x	0.7	=	78.48	(81)
Northwest 0.9x	0.77	x	4.6	x	67.96	x	0.85	x	0.7	=	128.89	(81)
Northwest 0.9x	0.77	x	4.6	x	91.35	x	0.85	x	0.7	=	173.26	(81)
Northwest 0.9x	0.77	x	4.6	x	97.38	x	0.85	x	0.7	=	184.71	(81)
Northwest 0.9x	0.77	x	4.6	x	91.1	x	0.85	x	0.7	=	172.8	(81)
Northwest 0.9x	0.77	x	4.6	x	72.63	x	0.85	x	0.7	=	137.75	(81)
Northwest 0.9x	0.77	x	4.6	x	50.42	x	0.85	x	0.7	=	95.63	(81)
Northwest 0.9x	0.77	x	4.6	x	28.07	x	0.85	x	0.7	=	53.24	(81)
Northwest 0.9x	0.77	x	4.6	x	14.2	x	0.85	x	0.7	=	26.93	(81)
Northwest 0.9x	0.77	x	4.6	x	9.21	x	0.85	x	0.7	=	17.48	(81)

Solar gains in watts, calculated for each month

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

(83)m=	45.01	83.79	133.52	197.09	249.64	260.54	245.9	204.75	155.23	97.69	55.21	37.69	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	470.9	505.59	539.59	579.61	608.76	598.94	572.55	538.52	502.92	469.1	452.48	453.83	(84)
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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.95	0.89	0.78	0.65	0.69	0.87	0.96	0.98	0.99	(86)

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

(87)m=	18.76	18.94	19.29	19.83	20.31	20.72	20.89	20.87	20.57	19.96	19.32	18.79	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.13	19.14	19.15	19.21	19.22	19.27	19.27	19.28	19.25	19.22	19.2	19.17	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.98	0.96	0.93	0.84	0.66	0.44	0.49	0.77	0.93	0.97	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=	16.34	16.6	17.11	17.91	18.58	19.1	19.24	19.23	18.93	18.12	17.19	16.4	(90)
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fLA = Living area ÷ (4) =

0.44 (91)

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

(92)m=	17.41	17.64	18.08	18.76	19.35	19.82	19.97	19.96	19.65	18.93	18.13	17.46	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	17.41	17.64	18.08	18.76	19.35	19.82	19.97	19.96	19.65	18.93	18.13	17.46	(93)
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8. Space heating calculation

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

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

(94)m=	0.98	0.97	0.95	0.92	0.84	0.7	0.53	0.58	0.8	0.92	0.97	0.98	(94)
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Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	459.55	489.84	514.52	531.84	513.84	421.01	306.13	313.17	401.45	433.82	436.87	444.08	(95)
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Monthly average external temperature from Table 8

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

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

(97)m=	1436.11	1383.9	1247.52	1020.12	785.04	516.12	333.54	349.42	557.52	855.7	1150.92	1405.67	(97)
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Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	726.56	600.81	545.35	351.56	201.77	0	0	0	0	313.88	514.12	715.42	
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Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 3969.47 (98)

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

84.1 (99)

9. Space heating requirements - individual heating systems (including micro CHFs)

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

100 (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)

726.56	600.81	545.35	351.56	201.77	0	0	0	0	313.88	514.12	715.42
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

726.56	600.81	545.35	351.56	201.77	0	0	0	0	313.88	514.12	715.42
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total ($kWh/year$) = $Sum(211)_{1..12} =$ 3969.47 (211)

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

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

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

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

Water heating

Output from water heater (calculated above)

159.76	140.92	148.24	133.24	130.82	117.26	112.96	123.47	123.11	138.14	145.63	156.03
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

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

Fuel for water heating, $kWh/month$

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

(219)m=	159.76	140.92	148.24	133.24	130.82	117.26	112.96	123.47	123.11	138.14	145.63	156.03
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = $Sum(219a)_{1..12} =$ 1629.57 (219)

Annual totals

$kWh/year$

$kWh/year$

Space heating fuel used, main system 1

3969.47

SAP WorkSheet: New dwelling design stage

Water heating fuel used		1629.57	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0	(231)
Electricity for lighting		289.55	(232)

10a Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =	523.57 (240)
Space heating - main system 2	(213) x	0	x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0 (242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1	(243)
Low-rate fraction	1.0 - (243) =		0	(244)
High-rate cost	(219) x (243) x	13.19	x 0.01 =	214.94 (245)
Low-rate cost	(219) x (244) x	13.19	x 0.01 =	0 (246)
Pumps, fans and electric keep-hot	(231)	13.19	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)	13.19	x 0.01 =	38.19 (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) =			776.71 (255)

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	3.54	(257)
SAP rating (Section 12)		50.6	(258)

12a CO2 emissions - individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	2060.15 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.519	=	845.75 (264)
Space and water heating	(261) + (262) + (263) + (264) =			2905.9 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0 (267)
Electricity for lighting	(232) x	0.519	=	150.28 (268)
Total CO2, kg/year			sum of (265)...(271) =	3056.18 (272)
CO2 emissions per m²			(272) ÷ (4) =	64.75 (273)

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El rating (section 14)

56

{274}

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	{211} x	3.07	=	12186.26	{261}
Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	5002.78	{264}
Space and water heating	{261} + {262} + {263} + {264} =			17189.04	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	0	{267}
Electricity for lighting	{232} x	0	=	888.93	{268}
'Total Primary Energy		sum of {265}...{271} =		18077.97	{272}
Primary energy kWh/m ² /year		{272} ÷ {4} =		383.01	{273}

SAP Input

Property Details: YC1 9Q1G

Address: Flat 1, 53 High Street, Bognor Regis, PO21 1RX
Located in: England
Region: South East England
UPRN:
Date of assessment: 05 March 2021
Date of certificate: 05 March 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Calculated 160.01
Water use <= 125 litres/ person/ day: True
PCDF Version: 471

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 54.2 m² 2.7 m
Living area: 28.9 m² (fraction 0.533)
Front of dwelling faces: South West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (SE)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (SW)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	16mm or more mm	0.7	0.63	1.8	1.8	1
Windows (SE)	16mm or more	0.7	0.63	1.4	2.1	1
Windows (SW)	16mm or more	0.7	0.63	1.4	4.9	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall (external)	South West	0	0
Windows (SE)		Wall (external)	South East	0	0
Windows (SW)		Wall (external)	South West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
Wall (external)	52.5	8.8	43.7	0.3	0	False	9
Wall (retail)	43.4	0	43.4	0.3	0	False	20
Wall (retail) stud	9.1	0	9.1	0.25	0	False	14
Roof (flat)	2.9	0	2.9	0.25	0		9
Ground Floor	54.2			0.19			110
Internal Elements							
Partitions	30						9
Party Elements							
Ceiling	51.3						20

Thermal bridges:

SAP Input

Thermal bridges: No information on thermal bridging (y= 0.15) (y = 0.15)

Ventilation:

Pressure test: No (Assumed)
 Ventilation: Natural ventilation (extract fans)
 Number of chimneys: 0
 Number of open flues: 0
 Number of fans: 2
 Number of passive stacks: 0
 Number of sides sheltered: 4
 Pressure test: 15

Main heating system:

Main heating system: Room heaters
 Electric (direct acting) room heaters
 Fuel: Electricity
 Info Source: SAP Tables
 SAP Table: 691
 Panel, convactor or radiant heaters
 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature > 45°C
 Unknown
 Boiler interlock: Yes

Main heating Control:

Main heating Control: Programmer and appliance thermostats
 Control code: 2603

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
 Water code: 903
 Fuel :Electricity
 Hot water cylinder
 Cylinder volume: 200 litres
 Cylinder insulation: Measured loss, 2.24kWh/day
 Primary pipework insulation: False
 Cylinderstat: True
 Cylinder in heated space: True
 Immersion: Single
 Solar panel: False

Others:

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 75%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: None
 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: 4E1901C

Address : Flat 1, 53 High Street, Bognor Regis, PO21 1RX

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	54.2 (1a)	2.7 (2a)	146.34 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.2 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	146.34 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				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) =	0.14 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.89 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.62 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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SAP WorkSheet: New dwelling design stage

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

0.79	0.78	0.76	0.68	0.67	0.59	0.59	0.57	0.62	0.67	0.7	0.73
------	------	------	------	------	------	------	------	------	------	-----	------

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= 0.81 0.8 0.79 0.73 0.72 0.67 0.67 0.66 0.69 0.72 0.74 0.77 (24d)

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

(25)m= 0.81 0.8 0.79 0.73 0.72 0.67 0.67 0.66 0.69 0.72 0.74 0.77 (25)

3. Heat losses and heat capacity parameter

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.8	1.8	3.24		(26)
Windows Type 1			2.1	$\times 1/[1/(1.4) + 0.04]$	2.78		(27)
Windows Type 2			4.9	$\times 1/[1/(1.4) + 0.04]$	6.5		(27)
Floor			54.2	0.19	10.298	110	5962 (28)
Walls Type1	52.5	8.8	43.7	0.3	13.11	9	393.3 (29)
Walls Type2	43.4	0	43.4	0.3	13.02	20	868 (29)
Walls Type3	9.1	0	9.1	0.25	2.28	14	127.4 (29)
Roof	2.9	0	2.9	0.25	0.73	9	26.1 (30)
Total area of elements, m²			162.1				(31)
Party ceiling			51.3			20	1026 (32b)
Internal wall **			30			9	270 (32c)

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

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

Fabric heat loss, W/K = S (A x U) (26) ... (30) + (32) = 51.95 (33)

Heat capacity Cm = S(A x k) ((28) ... (30) + (32) + (32a) ... (32e) = 8672.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 160.01 (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 24.32 (36)

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

Total fabric heat loss (33) + (36) = 76.26 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.27	38.68	38.1	35.4	34.9	32.54	32.54	32.1	33.45	34.9	35.92	36.99	(38)

Heat transfer coefficient, W/K

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

(39)m=	115.53	114.94	114.37	111.66	111.16	108.8	108.8	108.37	109.71	111.16	112.18	113.25	
													Average = Sum(39) _{1..12} / 12 = 111.66 (39)

Heat loss parameter (HLP), W/m²K

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

(40)m=	2.13	2.12	2.11	2.06	2.05	2.01	2.01	2	2.02	2.05	2.07	2.09	
													Average = Sum(40) _{1..12} / 12 = 2.06 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement kWh/year

Assumed occupancy, N

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$ 1.81 (42)

if TFA ≤ 13.9, N = 1

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

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold) 77.28 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	85.01	81.92	78.83	75.73	72.64	69.55	69.55	72.64	75.73	78.83	81.92	85.01	
													Total = Sum(44) _{1..12} = 927.36 (44)

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

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

(45)m=	126.06	110.26	113.77	99.19	95.18	82.13	76.11	87.33	88.38	102.99	112.42	122.09	
													Total = Sum(45) _{1..12} = 1215.91 (45)

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

(46)m=	18.91	16.54	17.07	14.88	14.28	12.32	11.42	13.1	13.26	15.45	16.86	18.31	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year $(48) \times (49) =$ 1.34 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$ 0 (54)

Enter (50) or (54) in (55) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(56)
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SAP WorkSheet: New dwelling design stage

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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)
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Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	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 × (41)m

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

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

(62)m=	167.73	147.89	155.44	139.51	136.84	122.45	117.77	129	128.7	144.66	152.74	163.75	(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=	167.73	147.89	155.44	139.51	136.84	122.45	117.77	129	128.7	144.66	152.74	163.75	
Output from water heater (annual) $\times 12$												1706.47	(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=	75.25	66.77	71.16	65.24	64.98	59.56	58.64	62.37	61.64	67.58	69.64	73.92	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	108.83	(66)

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

(67)m=	47.95	42.59	34.64	26.22	19.6	16.55	17.88	23.24	31.19	39.61	46.23	49.28	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	236	238.45	232.28	219.14	202.56	186.97	176.56	174.11	180.28	193.42	210	225.59	(68)
--------	-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------	------

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

(69)m=	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	(69)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	-72.56	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	101.14	99.35	95.65	90.61	87.34	82.73	78.81	83.83	85.61	90.83	96.72	99.36	(72)
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	469.07	464.37	446.54	419.95	393.47	370.22	357.22	365.15	381.06	407.83	436.92	458.21	(73)
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6. Solar gains

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

SAP WorkSheet: New dwelling design stage

Southeast 0.9x	0.54	x	2.1	x	36.79	x	0.63	x	0.7	=	16.56	(77)
Southeast 0.9x	0.54	x	2.1	x	62.67	x	0.63	x	0.7	=	28.21	(77)
Southeast 0.9x	0.54	x	2.1	x	85.75	x	0.63	x	0.7	=	38.6	(77)
Southeast 0.9x	0.54	x	2.1	x	106.25	x	0.63	x	0.7	=	47.82	(77)
Southeast 0.9x	0.54	x	2.1	x	119.01	x	0.63	x	0.7	=	53.56	(77)
Southeast 0.9x	0.54	x	2.1	x	118.15	x	0.63	x	0.7	=	53.18	(77)
Southeast 0.9x	0.54	x	2.1	x	113.91	x	0.63	x	0.7	=	51.27	(77)
Southeast 0.9x	0.54	x	2.1	x	104.39	x	0.63	x	0.7	=	46.98	(77)
Southeast 0.9x	0.54	x	2.1	x	92.85	x	0.63	x	0.7	=	41.79	(77)
Southeast 0.9x	0.54	x	2.1	x	69.27	x	0.63	x	0.7	=	31.18	(77)
Southeast 0.9x	0.54	x	2.1	x	44.07	x	0.63	x	0.7	=	19.84	(77)
Southeast 0.9x	0.54	x	2.1	x	31.49	x	0.63	x	0.7	=	14.17	(77)
Southwest 0.9x	0.54	x	4.9	x	36.79		0.63	x	0.7	=	38.64	(79)
Southwest 0.9x	0.54	x	4.9	x	62.67		0.63	x	0.7	=	65.82	(79)
Southwest 0.9x	0.54	x	4.9	x	85.75		0.63	x	0.7	=	90.06	(79)
Southwest 0.9x	0.54	x	4.9	x	106.25		0.63	x	0.7	=	111.59	(79)
Southwest 0.9x	0.54	x	4.9	x	119.01		0.63	x	0.7	=	124.98	(79)
Southwest 0.9x	0.54	x	4.9	x	118.15		0.63	x	0.7	=	124.08	(79)
Southwest 0.9x	0.54	x	4.9	x	113.91		0.63	x	0.7	=	119.63	(79)
Southwest 0.9x	0.54	x	4.9	x	104.39		0.63	x	0.7	=	109.63	(79)
Southwest 0.9x	0.54	x	4.9	x	92.85		0.63	x	0.7	=	97.51	(79)
Southwest 0.9x	0.54	x	4.9	x	69.27		0.63	x	0.7	=	72.74	(79)
Southwest 0.9x	0.54	x	4.9	x	44.07		0.63	x	0.7	=	46.28	(79)
Southwest 0.9x	0.54	x	4.9	x	31.49		0.63	x	0.7	=	33.07	(79)

Solar gains in watts, calculated for each month

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

{83)m=	55.2	94.03	128.65	159.41	178.55	177.26	170.9	156.62	139.3	103.92	66.12	47.24	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

{84)m=	524.27	558.4	575.19	579.35	572.02	547.48	528.12	521.77	520.37	511.75	503.04	505.45	(84)
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7. Heat internal to external (m, min / season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
{86)m=	0.97	0.96	0.95	0.92	0.88	0.79	0.68	0.7	0.83	0.92	0.96	0.97	(86)

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

{87)m=	18.24	18.45	18.83	19.4	19.95	20.48	20.76	20.73	20.36	19.65	18.88	18.24	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

{88)m=	19.25	19.25	19.26	19.29	19.3	19.33	19.33	19.33	19.32	19.3	19.29	19.27	(88)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	------

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

{89)m=	0.96	0.95	0.93	0.9	0.83	0.69	0.49	0.52	0.74	0.89	0.94	0.96	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

SAP WorkSheet: New dwelling design stage

(90)m=	15.77	16.07	16.63	17.45	18.23	18.93	19.22	19.2	18.78	17.82	16.72	15.78	(90)
fLA = Living area ÷ (4) =													(91)
												0.53	

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

(92)m=	17.09	17.34	17.8	18.49	19.15	19.76	20.04	20.02	19.62	18.8	17.87	17.09	(92)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(93)m=	17.09	17.34	17.8	18.49	19.15	19.76	20.04	20.02	19.62	18.8	17.87	17.09	(93)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

4. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.94	0.93	0.92	0.88	0.83	0.72	0.58	0.61	0.76	0.88	0.93	0.95	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	494.98	521.13	526.55	511.68	472.67	394.68	307.8	316.04	397.05	448.29	466.39	479.33	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm, W = [(39)m x [(93)m – (96)m]

(97)m=	1477.71	1429.56	1292.88	1070.58	828.3	560.92	374.5	392.13	605.61	911.02	1208.63	1459.96	(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=	731.15	610.46	570.15	402.41	264.58	0	0	0	0	344.27	534.41	729.59	
Total per year (kWh/year) = Sum(98) _{1,5,10...12} =													(98)
												4187.03	

Space heating requirement in kWh/m²/year

77.25 (99)

5. Primary space heating systems including micro-CHP

Space heating:

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

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

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

Efficiency of main space heating system 1 100 (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)

731.15	610.46	570.15	402.41	264.58	0	0	0	0	344.27	534.41	729.59
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(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

731.15	610.46	570.15	402.41	264.58	0	0	0	0	344.27	534.41	729.59
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Total (kWh/year) = Sum(211)_{1,5,10...12} = 4187.03 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

167.73	147.89	155.44	139.51	136.84	122.45	117.77	129	128.7	144.66	152.74	163.75
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Efficiency of water heater 100 (216)

SAP WorkSheet: New dwelling design stage

(217)m=	100	100	100	100	100	100	100	100	100	100	100	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	167.73	147.89	155.44	139.51	136.84	122.45	117.77	129	128.7	144.66	152.74	163.75	
Total = Sum(219a)...(219j) =												1706.47	(219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

Total electricity for the above, kWh/year

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

Electricity for lighting

10a. Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	552.27 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	225.08 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Pumps, fans and electric keep-hot	(231)	13.19 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)	13.19 x 0.01 =	44.68 (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) =		822.03 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	3.48	(257)
SAP rating (Section 12)		51.45	(258)

12a. CO2 emissions - individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	2173.07 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	885.66 (264)

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Space and water heating	{261} + {262} + {263} + {264} =			3058.73	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	0.519	=	0	{267}
Electricity for lighting	{232} x	0.519	=	175.8	{268}
Total CO2, kg/year	sum of {265} .. {271} =			3234.52	{272}
CO2 emissions per m²	{272} ÷ {4} =			59.68	{273}
El rating (section 14)				56	{274}

1.3a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	{211} x	3.07	=	12854.17	{261}
Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	5238.87	{264}
Space and water heating	{261} + {262} + {263} + {264} =			18093.04	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	0	{267}
Electricity for lighting	{232} x	0	=	1039.88	{268}
'Total Primary Energy	sum of {265}...{271} =			19132.91	{272}
Primary energy kWh/m²/year	{272} ÷ {4} =			353.01	{273}

SAP Input

Property Details: YCI 9020

Address: Flat 2, 53 High Street, Bognor Regis, PO21 1RX
Located in: England
Region: South East England
UPRN:
Date of assessment: 05 March 2021
Date of certificate: 05 March 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/ person/ day: True
PCDF Version: 471

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 40.7 m² 3.1 m
Living area: 21.4 m² (fraction 0.526)
Front of dwelling faces: North East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Windows (NW)	SAP 2012	Windows	Single-glazed	No	Wood
Windows (SE)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Windows (NW)		0.7	0.85	4.8	5.1	1
Windows (SE)	16mm or more	0.7	0.63	1.4	2.1	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Windows (NW)		Wall (external)	North West	0	0
Windows (SE)		Wall (external)	South West	0	0

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall (external)	20.5	7.2	13.3	0.3	0	False	N/A
Wall (retail)	31.7	0	31.7	0.3	0	False	N/A
Floor Over Shop	36.1			0.14			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
Party Wall	12.9						N/A
Party Wall	28.9						N/A

Thermal Bridging

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Ventilation

Pressure test: No (Assumed)

SAP Input

Ventilation: Natural ventilation (extract fans)
 Number of chimneys: 0
 Number of open flues: 0
 Number of fans: 2
 Number of passive stacks: 0
 Number of sides sheltered: 3
 Pressure test: 15

Main heating system

Main heating system: Room heaters
 Electric (direct acting) room heaters
 Fuel: Electricity
 Info Source: SAP Tables
 SAP Table: 691
 Panel, convector or radiant heaters

 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature > 45°C
 Unknown
 Boiler interlock: Yes

Main heating Control

Main heating Control: Programmer and appliance thermostats
 Control code: 2603

Secondary heating system

Secondary heating system: None

Water heating

Water heating: Electric immersion (on-peak or off-peak)
 Water code: 903
 Fuel :Electricity
 Hot water cylinder
 Cylinder volume: 200 litres
 Cylinder insulation: Measured loss, 2.24kWh/day
 Primary pipework insulation: False
 Cylinderstat: True
 Cylinder in heated space: True
 Immersion: Single
 Solar panel: False

Others

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 75%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: None
 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: 4E1902C

Address : Flat 2, 53 High Street, Bognor Regis, PO21 1RX

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	40.7 (1a)	3.1 (2a)	126.17 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	40.7 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	126.17 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				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) =	0.16 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.91 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.7 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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SAP WorkSheet: New dwelling design stage

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

0.9	0.88	0.86	0.77	0.76	0.67	0.67	0.65	0.7	0.76	0.79	0.83
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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= 0.9 0.89 0.87 0.8 0.79 0.72 0.72 0.71 0.75 0.79 0.81 0.84 (24d)

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

(25)m= 0.9 0.89 0.87 0.8 0.79 0.72 0.72 0.71 0.75 0.79 0.81 0.84 (25)

3. Heat losses and heat loss parameter

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			5.1	$\times 1/[1/(4.8) + 0.04] =$	20.54		(27)
Windows Type 2			2.1	$\times 1/[1/(1.4) + 0.04] =$	2.78		(27)
Floor			36.1	$\times$ 0.14	5.054		(28)
Walls Type1	20.5	7.2	13.3	$\times$ 0.3	3.99		(29)
Walls Type2	31.7	0	31.7	$\times$ 0.3	9.51		(29)
Total area of elements, m²			88.3				(31)
Party wall			12.9	$\times$ 0	0		(32)
Party wall			28.9	$\times$ 0.2	5.78		(32)

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

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

Fabric heat loss, W/K = S (A x U) (26) ... (30) + (32) = 47.66 (33)

Heat capacity Cm = S(A x k) ((23)...(30) + (32) + (32a)...(32e) = 9764.7 (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 13.25 (36)

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

Total fabric heat loss (33) + (36) = 60.9 (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=	37.6	36.94	36.31	33.31	32.74	30.13	30.13	29.65	31.14	32.74	33.88	35.07

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

(39)m= 98.5 97.84 97.21 94.21 93.64 91.03 91.03 90.55 92.04 93.64 94.78 95.97

Average = Sum(39) / 12 = 94.2 (39)

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Heat loss parameter (HLP), W/m²K

$$\{40\}m = \{39\}m + \{4\}$$

{40}m=	2.42	2.4	2.39	2.31	2.3	2.24	2.24	2.22	2.26	2.3	2.33	2.36		
	Average = Sum{40} / 12 =												2.31	{40}

Number of days in month (Table 1a)

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

4 Water heating energy requirement

Assumed occupancy, N

1.43

{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

68.05

{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=	74.85	72.13	69.41	66.68	63.96	61.24	61.24	63.96	66.68	69.41	72.13	74.85		
	Total = Sum{44} / 12 =												816.54	{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=	111	97.08	100.18	87.34	83.8	72.32	67.01	76.9	77.82	90.69	98.99	107.5		
	Total = Sum{45} / 12 =												1070.62	{45}

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

{46}m=	16.65	14.56	15.03	13.1	12.57	10.85	10.05	11.53	11.67	13.6	14.85	16.12		{46}
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	--	------

Water storage loss:

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

200

{47}

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

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

Water storage loss:

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

2.24

{48}

Temperature factor from Table 2b

0.6

{49}

Energy lost from water storage, kWh/year

$$\{48\} \times \{49\} =$$

1.34

{50}

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

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

0

{51}

If community heating see section 4.3

Volume factor from Table 2a

0

{52}

Temperature factor from Table 2b

0

{53}

Energy lost from water storage, kWh/year

$$\{47\} \times \{51\} \times \{52\} \times \{53\} =$$

0

{54}

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

1.34

{55}

Water storage loss calculated for each month

$$\{56\}m = \{55\} \times \{41\}m$$

{56}m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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 × (41)m

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

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

(62)m=	152.66	134.71	141.84	127.66	125.47	112.64	108.68	118.56	118.14	132.35	139.31	149.16	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

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

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

Output from water heater

(64)m=	152.66	134.71	141.84	127.66	125.47	112.64	108.68	118.56	118.14	132.35	139.31	149.16	
Output from water heater (annual): 1.12												1561.18	(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=	70.24	62.39	66.64	61.3	61.2	56.3	55.61	58.9	58.13	63.48	65.17	69.07	(65)
--------	-------	-------	-------	------	------	------	-------	------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	85.5	(66)

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

(67)m=	35	31.09	25.28	19.14	14.31	12.08	13.05	16.97	22.77	28.92	33.75	35.98	(67)
--------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(68)m=	184.03	185.94	181.12	170.88	157.95	145.79	137.67	135.76	140.58	150.82	163.75	175.91	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	44.98	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-57	-57	-57	-57	-57	-57	-57	-57	-57	-57	-57	-57	(71)
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

Water heating gains (Table 5)

(72)m=	94.41	92.84	89.57	85.13	82.25	78.2	74.75	79.17	80.74	85.33	90.51	92.84	(72)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	386.91	383.34	369.46	348.63	327.99	309.55	298.95	305.37	317.56	338.54	361.49	378.2	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g _s Table 6b		FF Table 6c		Gains (W)	
Southwest 0.9x	0.54	×	2.1	×	36.79		0.63	×	0.7	≈	16.56	(79)
Southwest 0.9x	0.54	×	2.1	×	62.67		0.63	×	0.7	≈	28.21	(79)
Southwest 0.9x	0.54	×	2.1	×	85.75		0.63	×	0.7	≈	38.6	(79)
Southwest 0.9x	0.54	×	2.1	×	106.25		0.63	×	0.7	≈	47.82	(79)
Southwest 0.9x	0.54	×	2.1	×	119.01		0.63	×	0.7	≈	53.56	(79)

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Southwest 0.9x	0.54	x	2.1	x	118.15	0.63	x	0.7	=	53.18	(79)
Southwest 0.9x	0.54	x	2.1	x	113.91	0.63	x	0.7	=	51.27	(79)
Southwest 0.9x	0.54	x	2.1	x	104.39	0.63	x	0.7	=	46.98	(79)
Southwest 0.9x	0.54	x	2.1	x	92.85	0.63	x	0.7	=	41.79	(79)
Southwest 0.9x	0.54	x	2.1	x	69.27	0.63	x	0.7	=	31.18	(79)
Southwest 0.9x	0.54	x	2.1	x	44.07	0.63	x	0.7	=	19.84	(79)
Southwest 0.9x	0.54	x	2.1	x	31.49	0.63	x	0.7	=	14.17	(79)
Northwest 0.9x	0.77	x	5.1	x	11.28	0.85	x	0.7	=	23.73	(81)
Northwest 0.9x	0.77	x	5.1	x	22.97	0.85	x	0.7	=	48.3	(81)
Northwest 0.9x	0.77	x	5.1	x	41.38	0.85	x	0.7	=	87.02	(81)
Northwest 0.9x	0.77	x	5.1	x	67.96	0.85	x	0.7	=	142.9	(81)
Northwest 0.9x	0.77	x	5.1	x	91.35	0.85	x	0.7	=	192.09	(81)
Northwest 0.9x	0.77	x	5.1	x	97.38	0.85	x	0.7	=	204.79	(81)
Northwest 0.9x	0.77	x	5.1	x	91.1	0.85	x	0.7	=	191.58	(81)
Northwest 0.9x	0.77	x	5.1	x	72.63	0.85	x	0.7	=	152.73	(81)
Northwest 0.9x	0.77	x	5.1	x	50.42	0.85	x	0.7	=	106.03	(81)
Northwest 0.9x	0.77	x	5.1	x	28.07	0.85	x	0.7	=	59.02	(81)
Northwest 0.9x	0.77	x	5.1	x	14.2	0.85	x	0.7	=	29.85	(81)
Northwest 0.9x	0.77	x	5.1	x	9.21	0.85	x	0.7	=	19.38	(81)

Solar gains in watts, calculated for each month

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

(83)m=	40.29	76.51	125.61	190.73	245.66	257.97	242.85	199.71	147.82	90.2	49.69	33.55	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	------	-------	-------	------

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

(84)m=	427.2	459.84	495.07	539.36	573.64	567.51	541.8	505.09	465.38	428.74	411.18	411.75	(84)
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.94	0.88	0.76	0.63	0.68	0.86	0.95	0.98	0.99	(86)

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

(87)m=	18.71	18.89	19.25	19.8	20.3	20.71	20.89	20.86	20.55	19.92	19.26	18.72	(87)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.07	19.08	19.09	19.13	19.14	19.18	19.18	19.19	19.16	19.14	19.12	19.11	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.98	0.97	0.96	0.91	0.82	0.63	0.41	0.47	0.75	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=	16.22	16.49	17.02	17.82	18.51	19.01	19.15	19.14	18.84	18.01	17.06	16.26	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.53 (91)

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

(92)m=	17.53	17.75	18.19	18.86	19.45	19.91	20.06	20.04	19.74	19.01	18.22	17.55	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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(93)m=	17.53	17.75	18.19	18.86	19.45	19.91	20.06	20.04	19.74	19.01	18.22	17.55	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating calculation

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

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

Utilisation factor for gains, h_m :

(94)m=	0.97	0.97	0.95	0.91	0.83	0.69	0.53	0.58	0.79	0.92	0.96	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	415.91	444.17	469.81	490.46	476.72	391.89	287.19	292.58	368.67	394.51	395.76	401.98	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1303.04	1257.48	1136.55	938.19	725.76	483	315.32	329.98	518.79	788	1053.79	1281.59	(97)
--------	---------	---------	---------	--------	--------	-----	--------	--------	--------	-----	---------	---------	------

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

(98)m=	660.03	546.54	496.06	322.37	185.28	0	0	0	0	292.75	473.78	654.43	
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 3631.25 (98)

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

89.22 (99)

9. Space heating requirements: individual heating systems, including micro CHPs

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

100 (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)

660.03	546.54	496.06	322.37	185.28	0	0	0	0	292.75	473.78	654.43
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

660.03	546.54	496.06	322.37	185.28	0	0	0	0	292.75	473.78	654.43
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total ($kWh/year$) = $Sum(211)_{1..12} =$ 3631.25 (211)

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

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

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

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

Water heating

Output from water heater (calculated above)

152.66	134.71	141.84	127.66	125.47	112.64	108.68	118.56	118.14	132.35	139.31	149.16
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

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

Fuel for water heating, $kWh/month$

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

(219)m=	152.66	134.71	141.84	127.66	125.47	112.64	108.68	118.56	118.14	132.35	139.31	149.16	
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

Total = $Sum(219a)_{1..12} =$ 1561.18 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3631.25

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Water heating fuel used		1561.18
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0 (231)
Electricity for lighting		247.28 (232)

10a Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19	478.96 (240)
Space heating - main system 2	(213) x	0	0 (241)
Space heating - secondary	(215) x	13.19	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	205.92 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Pumps, fans and electric keep-hot	(231)	13.19 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)	13.19 x 0.01 =	32.62 (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) =		717.5 (255)

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	3.52 (257)
SAP rating (Section 12)		50.92 (258)

12a CO2 emissions - individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	1884.62 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	810.25 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2694.87 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	0 (267)
Electricity for lighting	(232) x	0.519	128.34 (268)
Total CO2, kg/year		sum of (265)...(271) =	2823.21 (272)
CO2 emissions per m²		(272) ÷ (4) =	69.37 (273)

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El rating (section 14)

56

{274}

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	{211} x	3.07	=	11147.94	{261}
Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	4792.81	{264}
Space and water heating	{261} + {262} + {263} + {264} =			15940.75	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	0	{267}
Electricity for lighting	{232} x	0	=	759.14	{268}
'Total Primary Energy	sum of {265}...{271} =			16699.89	{272}
Primary energy kWh/m²/year	{272} ÷ {4} =			410.32	{273}

SAP Input

Property Details: YCI 9935

Address: Flat 3, 53 High Street, Bognor Regis, PO21 1RX
Located in: England
Region: South East England
UPRN:
Date of assessment: 05 March 2021
Date of certificate: 05 March 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/ person/ day: True
PCDF Version: 471

Property description

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 51.1 m² 2.6 m
Living area: 22.4 m² (fraction 0.438)
Front of dwelling faces: North West

Opening types

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Windows (SE)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (SW)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Windows (SE)	16mm or more	0.7	0.63	1.4	2.9	1
Windows (SW)	16mm or more	0.7	0.63	1.4	5.6	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Windows (SE)		Wall (external)	South East	0	0
Windows (SW)		Wall (external)	South West	0	0

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall (external)	48.1	8.5	39.6	0.3	0	False	N/A
Roof	51.1	0	51.1	0.15	0		N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
Party Wall	39.3						N/A
Party Wall	8.8						N/A

Thermal bridges

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Ventilation

Pressure test: No (Assumed)

SAP Input

Ventilation: Natural ventilation (extract fans)
 Number of chimneys: 0
 Number of open flues: 0
 Number of fans: 2
 Number of passive stacks: 0
 Number of sides sheltered: 3
 Pressure test: 15

Main heating system

Main heating system: Room heaters
 Electric (direct acting) room heaters
 Fuel: Electricity
 Info Source: SAP Tables
 SAP Table: 691
 Panel, convector or radiant heaters

 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature > 45°C
 Unknown
 Boiler interlock: Yes

Main heating Control

Main heating Control: Programmer and appliance thermostats
 Control code: 2603

Secondary heating system

Secondary heating system: None

Water heating

Water heating: Electric immersion (on-peak or off-peak)
 Water code: 903
 Fuel :Electricity
 Hot water cylinder
 Cylinder volume: 200 litres
 Cylinder insulation: Measured loss, 2.24kWh/day
 Primary pipework insulation: False
 Cylinderstat: True
 Cylinder in heated space: True
 Immersion: Single
 Solar panel: False

Others

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 75%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: None
 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: 4E1903C

Address : Flat 3, 53 High Street, Bognor Regis, PO21 1RX

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.1 (1a)	2.6 (2a)	132.86 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.1 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	132.86 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				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) =	0.15 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.9 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.7 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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SAP WorkSheet: New dwelling design stage

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

0.89	0.87	0.85	0.77	0.75	0.66	0.66	0.65	0.7	0.75	0.79	0.82
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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)m x 0.5]

(24d)m= 0.9 0.88 0.87 0.79 0.78 0.72 0.72 0.71 0.74 0.78 0.81 0.84 (24d)

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

(25)m= 0.9 0.88 0.87 0.79 0.78 0.72 0.72 0.71 0.74 0.78 0.81 0.84 (25)

3. Heat losses and heat capacity parameter

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			2.9	$\times 1/[1/(1.4) + 0.04] =$	3.84		(27)
Windows Type 2			5.6	$\times 1/[1/(1.4) + 0.04] =$	7.42		(27)
Walls	48.1	8.5	39.6	$\times$ 0.3	11.88		(29)
Roof	51.1	0	51.1	$\times$ 0.15	7.67		(30)
Total area of elements, m ²			99.2				(31)
Party wall			39.3	$\times$ 0	0		(32)
Party wall			8.8	$\times$ 0.2	1.76		(32)

* 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) = 32.57 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 8066.3 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 14.88 (36)

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

Total fabric heat loss (33) + (36) = 47.45 (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=	39.28	38.61	37.95	34.84	34.26	31.56	31.56	31.06	32.6	34.26	35.44	36.66

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

(39)m=	86.73	86.06	85.4	82.3	81.72	79.01	79.01	78.51	80.05	81.72	82.89	84.12
Average = Sum(39)...12/12=												82.29 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$\{40\}m = \{39\}m + \{4\}$$

{40}m=	1.7	1.68	1.67	1.61	1.6	1.55	1.55	1.54	1.57	1.6	1.62	1.65		
Average = Sum{40} / 12 =													1.61	{40}

Number of days in month (Table 1a)

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

4 Water heating energy requirement

Assumed occupancy, N

1.72

{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

75.11

{43}

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
{44}m=	82.62	79.62	76.61	73.61	70.6	67.6	67.6	70.6	73.61	76.61	79.62	82.62		
Total = Sum{44} / 12 =													901.32	{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=	122.52	107.16	110.58	96.41	92.5	79.82	73.97	84.88	85.89	100.1	109.27	118.66		
Total = Sum{45} / 12 =													1181.77	{45}

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

{46}m=	18.38	16.07	16.59	14.46	13.88	11.97	11.1	12.73	12.88	15.02	16.39	17.8		{46}
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Water storage loss:

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

200

{47}

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

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

Water storage loss:

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

2.24

{48}

Temperature factor from Table 2b

0.6

{49}

Energy lost from water storage, kWh/year

$$\{48\} \times \{49\} =$$

1.34

{50}

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

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

0

{51}

If community heating see section 4.3

Volume factor from Table 2a

0

{52}

Temperature factor from Table 2b

0

{53}

Energy lost from water storage, kWh/year

$$\{47\} \times \{51\} \times \{52\} \times \{53\} =$$

0

{54}

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

1.34

{55}

Water storage loss calculated for each month

$$\{56\}m = \{55\} \times \{41\}m$$

{56}m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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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SAP WorkSheet: New dwelling design stage

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

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

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

(62)m=	164.19	144.79	152.24	136.73	134.17	120.14	115.63	126.54	126.21	141.77	149.59	160.32	(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	(63)
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Output from water heater

(64)m=	164.19	144.79	152.24	136.73	134.17	120.14	115.63	126.54	126.21	141.77	149.59	160.32	
Output from water heater (annual): 1.12												1672.33	(64)

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

(65)m=	74.07	65.74	70.1	64.31	64.09	58.8	57.93	61.55	60.82	66.61	68.59	72.79	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	103.35	(66)

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

(67)m=	44.51	39.53	32.15	24.34	18.19	15.36	16.6	21.57	28.95	36.76	42.91	45.74	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	224.02	226.34	220.48	208.01	192.27	177.47	167.59	165.27	171.12	183.59	199.34	214.13	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	47.06	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	-68.9	(71)
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Water heating gains (Table 5)

(72)m=	99.56	97.82	94.22	89.32	86.14	81.66	77.86	82.73	84.47	89.54	95.26	97.83	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	449.59	445.2	428.36	403.18	378.11	356	343.55	351.08	366.05	391.4	419.01	439.21	(73)
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6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g _g Table 6b	FF Table 6c	Gains (W)	
Southeast 0.9x	0.77	2.9	36.79	0.63	0.7	32.61	(77)
Southeast 0.9x	0.77	2.9	62.67	0.63	0.7	55.55	(77)
Southeast 0.9x	0.77	2.9	85.75	0.63	0.7	76	(77)
Southeast 0.9x	0.77	2.9	106.25	0.63	0.7	94.17	(77)
Southeast 0.9x	0.77	2.9	119.01	0.63	0.7	105.48	(77)

SAP WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	2.9	x	118.15	x	0.63	x	0.7	=	104.71	(77)
Southeast 0.9x	0.77	x	2.9	x	113.91	x	0.63	x	0.7	=	100.96	(77)
Southeast 0.9x	0.77	x	2.9	x	104.39	x	0.63	x	0.7	=	92.52	(77)
Southeast 0.9x	0.77	x	2.9	x	92.85	x	0.63	x	0.7	=	82.29	(77)
Southeast 0.9x	0.77	x	2.9	x	69.27	x	0.63	x	0.7	=	61.39	(77)
Southeast 0.9x	0.77	x	2.9	x	44.07	x	0.63	x	0.7	=	39.06	(77)
Southeast 0.9x	0.77	x	2.9	x	31.49	x	0.63	x	0.7	=	27.91	(77)
Southwest 0.9x	0.54	x	5.6	x	36.79		0.63	x	0.7	=	44.16	(79)
Southwest 0.9x	0.54	x	5.6	x	62.67		0.63	x	0.7	=	75.22	(79)
Southwest 0.9x	0.54	x	5.6	x	85.75		0.63	x	0.7	=	102.92	(79)
Southwest 0.9x	0.54	x	5.6	x	106.25		0.63	x	0.7	=	127.53	(79)
Southwest 0.9x	0.54	x	5.6	x	119.01		0.63	x	0.7	=	142.84	(79)
Southwest 0.9x	0.54	x	5.6	x	118.15		0.63	x	0.7	=	141.81	(79)
Southwest 0.9x	0.54	x	5.6	x	113.91		0.63	x	0.7	=	136.72	(79)
Southwest 0.9x	0.54	x	5.6	x	104.39		0.63	x	0.7	=	125.29	(79)
Southwest 0.9x	0.54	x	5.6	x	92.85		0.63	x	0.7	=	111.44	(79)
Southwest 0.9x	0.54	x	5.6	x	69.27		0.63	x	0.7	=	83.14	(79)
Southwest 0.9x	0.54	x	5.6	x	44.07		0.63	x	0.7	=	52.89	(79)
Southwest 0.9x	0.54	x	5.6	x	31.49		0.63	x	0.7	=	37.79	(79)

Solar gains in watts, calculated for each month

$$(83)m = \text{Sum}(74)m \dots (82)m$$

(83)m=	76.77	130.77	178.92	221.69	248.32	246.52	237.67	217.81	193.74	144.53	91.95	65.7	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	526.36	575.97	607.28	624.87	626.43	602.53	581.22	568.89	559.79	535.93	510.97	504.91	(84)
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7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.93	0.86	0.72	0.56	0.59	0.79	0.93	0.98	0.99	(86)

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

(87)m=	19.45	19.62	19.9	20.3	20.63	20.88	20.97	20.96	20.81	20.4	19.89	19.46	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.54	19.55	19.56	19.61	19.61	19.65	19.65	19.66	19.64	19.61	19.6	19.58	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.97	0.95	0.91	0.81	0.61	0.41	0.44	0.7	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=	17.57	17.83	18.24	18.82	19.26	19.58	19.64	19.65	19.5	18.98	18.25	17.61	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

0.44 (91)

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

(92)m=	18.39	18.62	18.97	19.47	19.86	20.15	20.22	20.22	20.08	19.61	18.97	18.42	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

SAP WorkSheet: New dwelling design stage

(93)m=	18.39	18.62	18.97	19.47	19.86	20.15	20.22	20.22	20.08	19.61	18.97	18.42	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating calculation

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

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

Utilisation factor for gains, h_m :

(94)m=	0.97	0.96	0.94	0.9	0.82	0.66	0.48	0.51	0.73	0.9	0.96	0.98	(94)
--------	------	------	------	-----	------	------	------	------	------	-----	------	------	------

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

(95)m=	513.15	555.26	573.56	563.86	513.61	396.3	277.41	288.7	409.43	482.19	490.47	493.85	(95)
--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1222.27	1180.39	1064.86	869.85	667.02	438.47	286.25	300.03	478.6	735.86	984.06	1196.22	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	-------	--------	--------	---------	------

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

(98)m=	527.59	420.08	365.53	220.32	114.13	0	0	0	0	188.73	355.38	522.56	
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2714.32 (98)

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

53.12 (99)

9. Space heating requirements - individual heating systems (including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

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

1 (202)

Fraction of total heating from main system 1

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

1 (204)

Efficiency of main space heating system 1

100 (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)

527.59	420.08	365.53	220.32	114.13	0	0	0	0	188.73	355.38	522.56
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

527.59	420.08	365.53	220.32	114.13	0	0	0	0	188.73	355.38	522.56
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total ($kWh/year$) = $Sum(211)_{1..12} =$ 2714.32 (211)

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

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

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

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

Water heating

Output from water heater (calculated above)

164.19	144.79	152.24	136.73	134.17	120.14	115.63	126.54	126.21	141.77	149.59	160.32
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	(217)
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Fuel for water heating, $kWh/month$

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

(219)m=	164.19	144.79	152.24	136.73	134.17	120.14	115.63	126.54	126.21	141.77	149.59	160.32	
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

Total = $Sum(219a)_{1..12} =$ 1672.33 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

2714.32

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Water heating fuel used		1672.33
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0 (231)
Electricity for lighting		314.4 (232)

10a Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19	358.02 (240)
Space heating - main system 2	(213) x	0	0 (241)
Space heating - secondary	(215) x	13.19	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19	220.58 (245)
Low-rate cost	(219) x (244) x	13.19	0 (246)
Pumps, fans and electric keep-hot	(231)	13.19	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)	13.19	41.47 (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) =		620.07 (255)

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	2.71 (257)
SAP rating (Section 12)		62.2 (258)

12a CO2 emissions - individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	1408.73 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	867.94 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2276.67 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	0 (267)
Electricity for lighting	(232) x	0.519	163.17 (268)
Total CO2, kg/year		sum of (265)...(271) =	2439.85 (272)
CO2 emissions per m²		(272) ÷ (4) =	47.75 (273)

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El rating (section 14)

66

{274}

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	{211} x	3.07	=	8332.96	{261}
Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	5134.05	{264}
Space and water heating	{261} + {262} + {263} + {264} =			13467.02	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	0	{267}
Electricity for lighting	{232} x	0	=	965.21	{268}
'Total Primary Energy		sum of {265}...{271} =		14432.23	{272}
Primary energy kWh/m ² /year		{272} ÷ {4} =		282.43	{273}

SAP Input

Property Details: YC19040

Address: Flat 4, 53 High Street, Bognor Regis, PO21 1RX
Located in: England
Region: South East England
UPRN:
Date of assessment: 05 March 2021
Date of certificate: 05 March 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/ person/ day: True
PCDF Version: 471

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 47.2 m² 2.7 m
Living area: 20.9 m² (fraction 0.443)
Front of dwelling faces: South East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Windows (NW)	SAP 2012	Windows	Single-glazed	No	Wood
Windows (SE)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Windows (NW)		0.7	0.85	4.8	4.6	1
Windows (SE)	16mm or more	0.7	0.63	1.4	2.1	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Windows (NW)		Wall (external)	North West	0	0
Windows (SE)		Wall (external)	South West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall (external)	50.3	6.7	43.6	0.3	0	False	N/A
Roof	47.2	0	47.2	0.15	0		N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
Party Wall	19.8						N/A
Party Wall	16.8						N/A

Thermal Bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y=0.15)

Ventilation:

Pressure test: No (Assumed)

SAP Input

Ventilation: Natural ventilation (extract fans)
 Number of chimneys: 0
 Number of open flues: 0
 Number of fans: 2
 Number of passive stacks: 0
 Number of sides sheltered: 1
 Pressure test: 15

Main heating system

Main heating system: Room heaters
 Electric (direct acting) room heaters
 Fuel: Electricity
 Info Source: SAP Tables
 SAP Table: 691
 Panel, convector or radiant heaters

 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature > 45°C
 Unknown
 Boiler interlock: Yes

Main heating Control

Main heating Control: Programmer and appliance thermostats
 Control code: 2603

Secondary heating system

Secondary heating system: None

Water heating

Water heating: Electric immersion (on-peak or off-peak)
 Water code: 903
 Fuel :Electricity
 Hot water cylinder
 Cylinder volume: 200 litres
 Cylinder insulation: Measured loss, 2.24kWh/day
 Primary pipework insulation: False
 Cylinderstat: True
 Cylinder in heated space: True
 Immersion: Single
 Solar panel: False

Others

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 75%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: None
 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: 4E1904C

Address : Flat 4, 53 High Street, Bognor Regis, PO21 1RX

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	47.2 (1a)	2.7 (2a)	127.44 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	47.2 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	127.44 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				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) =	0.16 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.91 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.84 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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SAP WorkSheet: New dwelling design stage

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

1.07	1.05	1.03	0.92	0.9	0.8	0.8	0.78	0.84	0.9	0.94	0.99
------	------	------	------	-----	-----	-----	------	------	-----	------	------

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)m x 0.5]

(24d)m= 1.07 1.05 1.03 0.93 0.91 0.82 0.82 0.8 0.85 0.91 0.95 0.99 (24d)

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

(25)m= 1.07 1.05 1.03 0.93 0.91 0.82 0.82 0.8 0.85 0.91 0.95 0.99 (25)

3. Heat losses and heat capacity parameter

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			4.6	$\times 1/[1/(4.8) + 0.04] =$	18.52		(27)
Windows Type 2			2.1	$\times 1/[1/(1.4) + 0.04] =$	2.78		(27)
Walls	50.3	6.7	43.6	$\times$ 0.3	13.08		(29)
Roof	47.2	0	47.2	$\times$ 0.15	7.08		(30)
Total area of elements, m ²			97.5				(31)
Party wall			19.8	$\times$ 0	0		(32)
Party wall			16.8	$\times$ 0.2	3.36		(32)

* 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) = 44.83 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 4717.2 (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 14.63 (36)

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

Total fabric heat loss (33) + (36) = 59.45 (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=	44.98	44.1	43.22	38.93	38.13	34.38	34.38	33.69	35.83	38.13	39.76	41.46

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

(39)m=	104.44	103.55	102.67	98.39	97.58	93.84	93.84	93.14	95.28	97.58	99.21	100.91
Average = Sum(39)...12/12=												98.37 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$\{40\}m = \{39\}m + \{4\}$$

{40}m=	2.21	2.19	2.18	2.08	2.07	1.99	1.99	1.97	2.02	2.07	2.1	2.14		
Average = Sum{40}/12=													2.08	{40}

Number of days in month (Table 1a)

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

4 Water heating energy requirement

Assumed occupancy, N

1.61

{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

72.39

{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=	79.63	76.74	73.84	70.94	68.05	65.15	65.15	68.05	70.94	73.84	76.74	79.63		
Total = Sum{44}/12 =													868.71	{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=	118.09	103.28	106.58	92.92	89.16	76.94	71.29	81.81	82.79	96.48	105.31	114.36		
Total = Sum{45}/12 =													1139.01	{45}

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

{46}m=	17.71	15.49	15.99	13.94	13.37	11.54	10.69	12.27	12.42	14.47	15.8	17.15		{46}
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Water storage loss:

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

200

{47}

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

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

Water storage loss:

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

2.24

{48}

Temperature factor from Table 2b

0.6

{49}

Energy lost from water storage, kWh/year

$$\{48\} \times \{49\} =$$

1.34

{50}

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

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

0

{51}

If community heating see section 4.3

Volume factor from Table 2a

0

{52}

Temperature factor from Table 2b

0

{53}

Energy lost from water storage, kWh/year

$$\{47\} \times \{51\} \times \{52\} \times \{53\} =$$

0

{54}

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

1.34

{55}

Water storage loss calculated for each month

$$\{56\}m = \{55\} \times \{41\}m$$

{56}m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66		{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 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	159.76	140.92	148.24	133.24	130.82	117.26	112.96	123.47	123.11	138.14	145.63	156.03	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	159.76	140.92	148.24	133.24	130.82	117.26	112.96	123.47	123.11	138.14	145.63	156.03	
Output from water heater (annual): 1.12												1629.57	(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=	72.6	64.45	68.77	63.15	62.98	57.84	57.04	60.53	59.78	65.41	67.27	71.36	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	96.49	(66)

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

(67)m=	40.99	36.41	29.61	22.41	16.76	14.15	15.28	19.87	26.67	33.86	39.52	42.13	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	208.91	211.07	205.61	193.98	179.3	165.5	156.29	154.12	159.58	171.21	185.89	199.69	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	-64.32	(71)
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Water heating gains (Table 5)

(72)m=	97.58	95.9	92.43	87.71	84.65	80.33	76.66	81.36	83.03	87.92	93.43	95.91	(72)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	425.89	421.8	406.07	382.53	359.12	338.4	326.65	333.77	347.7	371.41	397.26	416.15	(73)
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6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g _g Table 6b	FF Table 6c	Gains (W)	
Southwest 0.9x	0.77	2.1	36.79	0.63	0.7	23.61	(79)
Southwest 0.9x	0.77	2.1	62.67	0.63	0.7	40.22	(79)
Southwest 0.9x	0.77	2.1	85.75	0.63	0.7	55.03	(79)
Southwest 0.9x	0.77	2.1	106.25	0.63	0.7	68.19	(79)
Southwest 0.9x	0.77	2.1	119.01	0.63	0.7	76.38	(79)

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Southwest 0.9x	0.77	x	2.1	x	118.15	0.63	x	0.7	=	75.83	(79)
Southwest 0.9x	0.77	x	2.1	x	113.91	0.63	x	0.7	=	73.11	(79)
Southwest 0.9x	0.77	x	2.1	x	104.39	0.63	x	0.7	=	67	(79)
Southwest 0.9x	0.77	x	2.1	x	92.85	0.63	x	0.7	=	59.59	(79)
Southwest 0.9x	0.77	x	2.1	x	69.27	0.63	x	0.7	=	44.46	(79)
Southwest 0.9x	0.77	x	2.1	x	44.07	0.63	x	0.7	=	28.28	(79)
Southwest 0.9x	0.77	x	2.1	x	31.49	0.63	x	0.7	=	20.21	(79)
Northwest 0.9x	0.77	x	4.6	x	11.28	0.85	x	0.7	=	21.4	(81)
Northwest 0.9x	0.77	x	4.6	x	22.97	0.85	x	0.7	=	43.56	(81)
Northwest 0.9x	0.77	x	4.6	x	41.38	0.85	x	0.7	=	78.48	(81)
Northwest 0.9x	0.77	x	4.6	x	67.96	0.85	x	0.7	=	128.89	(81)
Northwest 0.9x	0.77	x	4.6	x	91.35	0.85	x	0.7	=	173.26	(81)
Northwest 0.9x	0.77	x	4.6	x	97.38	0.85	x	0.7	=	184.71	(81)
Northwest 0.9x	0.77	x	4.6	x	91.1	0.85	x	0.7	=	172.8	(81)
Northwest 0.9x	0.77	x	4.6	x	72.63	0.85	x	0.7	=	137.75	(81)
Northwest 0.9x	0.77	x	4.6	x	50.42	0.85	x	0.7	=	95.63	(81)
Northwest 0.9x	0.77	x	4.6	x	28.07	0.85	x	0.7	=	53.24	(81)
Northwest 0.9x	0.77	x	4.6	x	14.2	0.85	x	0.7	=	26.93	(81)
Northwest 0.9x	0.77	x	4.6	x	9.21	0.85	x	0.7	=	17.48	(81)

Solar gains in watts, calculated for each month

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

(83)m=	45.01	83.79	133.52	197.09	249.64	260.54	245.9	204.75	155.23	97.69	55.21	37.69	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	470.9	505.59	539.59	579.61	608.76	598.94	572.55	538.52	502.92	469.1	452.48	453.83	(84)
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7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.95	0.89	0.77	0.63	0.68	0.86	0.95	0.98	0.99	(86)

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

(87)m=	18.87	19.04	19.38	19.91	20.38	20.76	20.91	20.89	20.61	20.03	19.41	18.9	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.2	19.21	19.22	19.28	19.29	19.34	19.34	19.35	19.32	19.29	19.27	19.24	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.98	0.96	0.92	0.83	0.64	0.43	0.48	0.76	0.93	0.97	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=	16.53	16.79	17.29	18.07	18.71	19.19	19.32	19.31	19.03	18.26	17.36	16.6	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =

0.44 (91)

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

(92)m=	17.56	17.79	18.22	18.88	19.45	19.89	20.02	20.01	19.73	19.04	18.27	17.62	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	17.56	17.79	18.22	18.88	19.45	19.89	20.02	20.01	19.73	19.04	18.27	17.62	(93)
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8. Space heating calculation

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

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

(94)m=	0.98	0.97	0.95	0.92	0.84	0.69	0.52	0.57	0.79	0.92	0.97	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	459.72	489.95	514.44	530.9	510.88	414.48	298.72	306.29	398	433.23	436.92	444.25	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1385.15	1334.47	1202.86	982.18	755.79	496.06	321.13	336.29	536.7	824.04	1108.21	1353.83	(97)
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Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	688.53	567.52	512.19	324.92	182.21	0	0	0	0	290.76	483.33	676.73	
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Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ **3726.19** (98)

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

78.94 (99)

9. Energy requirements - individual heating systems (including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

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

1 (202)

Fraction of total heating from main system 1

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

1 (204)

Efficiency of main space heating system 1

100 (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)

688.53	567.52	512.19	324.92	182.21	0	0	0	0	290.76	483.33	676.73
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

688.53	567.52	512.19	324.92	182.21	0	0	0	0	290.76	483.33	676.73
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total ($kWh/year$) = $Sum(211)_{1..12} =$ **3726.19** (211)

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

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

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

Water heating

Output from water heater (calculated above)

159.76	140.92	148.24	133.24	130.82	117.26	112.96	123.47	123.11	138.14	145.63	156.03
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Efficiency of water heater

100 (216)

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

Fuel for water heating, $kWh/month$

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

(219)m=	159.76	140.92	148.24	133.24	130.82	117.26	112.96	123.47	123.11	138.14	145.63	156.03
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Total = $Sum(219a)_{1..12} =$ **1629.57** (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3726.19

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Water heating fuel used		1629.57
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0 (231)
Electricity for lighting		289.55 (232)

10a Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19	491.48 (240)
Space heating - main system 2	(213) x	0	0 (241)
Space heating - secondary	(215) x	13.19	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	214.94 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Pumps, fans and electric keep-hot	(231)	13.19 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)	13.19 x 0.01 =	38.19 (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) =		744.62 (255)

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	3.39 (257)
SAP rating (Section 12)		52.68 (258)

12a CO2 emissions - individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	1933.89 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	845.75 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2779.64 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	0 (267)
Electricity for lighting	(232) x	0.519	150.28 (268)
Total CO2, kg/year		sum of (265)...(271) =	2929.92 (272)
CO2 emissions per m²		(272) ÷ (4) =	62.07 (273)

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El rating (section 14)

57

{274}

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	{211} x	3.07	=	11439.4	{261}
Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	5002.78	{264}
Space and water heating	{261} + {262} + {263} + {264} =			16442.18	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	0	{267}
Electricity for lighting	{232} x	0	=	888.93	{268}
'Total Primary Energy	sum of {265}...{271} =			17331.11	{272}
Primary energy kWh/m ² /year	{272} ÷ {4} =			367.18	{273}