

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.49
 Printed on 20 October 2021 at 13:36:07

Project Information:

Assessed By: Dominic Bibby (STRO034470)

Building Type: Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 146.85m²

Site Reference : ZJ-22

Plot Reference: ZJ-22 plot 2

Address : L Apache, Westergate Street, Woodgate, CHICHESTER, PO20 3SQ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 24.67 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.17 kg/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 59.6 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 55.2 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.21 (max. 0.35)	OK
Openings	1.62 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Heat pumps with radiators or underfloor heating - electric
 Air source heat pump with flow temperature <= 35°C

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.09 kWh/day	
	Permitted by DBSCG: 2.56 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

Regulations Compliance Report

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summer time temperature

Overheating risk (South England):	Slight	OK
-----------------------------------	--------	----

Based on:

Overshading:	Average or unknown
Windows facing: North	12.84m ²
Windows facing: South	5.52m ²
Windows facing: East	4.18m ²
Windows facing: West	0.6m ²
Ventilation rate:	4.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Thermal bridging	0.038 W/m ² K
Roofs U-value	0.11 W/m ² K

SAP Input

Property Details: 21-02-stg-2

Address: L Apache, Westergate Street, Woodgate, CHICHESTER, PO20 3SQ
Located in: England
Region: South England
UPRN: UPRN-100061711751
Date of assessment: 20 October 2021
Date of certificate: 20 October 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 Low
Water use <= 125 litres/ person/ day: True
PCDF Version: 484

Property Description

Dwelling type: House
Detachment: Detached
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 86.82 m² 2.45 m
 Floor 1 60.03 m² 2.66 m
Living area: 19.39 m² (fraction 0.132)
Front of dwelling faces: South

Opening Types

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front door	Manufacturer	Solid			Wood
North	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
south	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
east	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
west	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	mm	0.7	0	1.8	1.89	1
North	16mm or more	0.7	0.63	1.6	12.84	1
south	16mm or more	0.7	0.63	1.6	5.52	1
east	16mm or more	0.7	0.63	1.6	4.18	1
west	16mm or more	0.7	0.63	1.6	0.6	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front door		Brick	South	0	0
North		Brick	North	0	0
south		Brick	South	0	0
east		Brick	East	0	0
west		Brick	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>							
Brick	187.5	25.03	162.47	0.24	0	False	N/A
Sloped GF	24	0	24	0.21	0		N/A
Flat ceiling	46.98	0	46.98	0.11	0		N/A
GF bay roof	0.7	0	0.7	0.2	0		N/A
Sloped	18.45	0	18.45	0.21	0		N/A

SAP Input

Ground floor 86.82 0.17 N/A

Internal Elements

Party Elements

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0381

Length	Psi-value		
15.55	0.358	E1	Steel lintel with perforated steel base plate
11.05	0.02	E3	Sill
37.8	0.016	E4	Jamb
44	0.097	E5	Ground floor (normal)
32	0	E6	Intermediate floor within a dwelling
21.6	0.055	E11	Eaves (insulation at rafter level)
11.2	0.085	E13	Gable (insulation at rafter level)
24.3	0.068	E16	Corner (normal)
4.9	-0.119	E17	Corner (inverted internal area greater than external area)

Ventilation

Pressure test: Yes (As designed)

Ventilation: Natural ventilation (extract fans)

Number of chimneys: 0

Number of open flues: 0

Number of fans: 5

Number of passive stacks: 0

Number of sides sheltered: 0

Pressure test: 5

Main heating system

Main heating system: Heat pumps with radiators or underfloor heating

Electric heat pumps

Fuel: Electricity

Info Source: SAP Tables

SAP Table: 214

Air source heat pump with flow temperature $\leq 35^{\circ}\text{C}$

Underfloor heating and radiators, pipes in screed above insulation

Central heating pump : 2013 or later

Design flow temperature: Design flow temperature $> 45^{\circ}\text{C}$

Unknown

Boiler interlock: Yes

MCS Installation Certificate

Main heating Control

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical services

Control code: 2207

Secondary heating system

Secondary heating system: None

Water heating

Water heating: From main heating system

Water code: 901

Fuel :Electricity

Hot water cylinder

Cylinder volume: 250 litres

Cylinder insulation: Measured loss, 2.09kWh/day

Primary pipework insulation: True

Cylinderstat: True

Cylinder in heated space: True

SAP Input

Solar panel: False

Others

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

FSAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Dominic Bibby

Stroma Number:

STRO034470

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.49

Property Address: 21-22 plot 2

Address : L Apache, Westergate Street, Woodgate, CHICHESTER, PO20 3SQ

1. General dwelling dimensions

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	86.82	(1a) x	2.45	(2a) =	212.71 (3a)
First floor	60.03	(1b) x	2.66	(2b) =	159.68 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	146.85	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	372.39 (5)

2. Ventilation rate

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0 (6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0 (6b)
Number of intermittent fans							5	x 10 =	50 (7a)
Number of passive vents							0	x 10 =	0 (7b)
Number of flueless gas fires							0	x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50	÷ (5) =	0.13	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38	(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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

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

	0.49	0.48	0.47	0.42	0.41	0.37	0.37	0.36	0.38	0.41	0.43	0.45
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

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

(23b)

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

(23c)

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

(24a)m=

(24a)

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

(24b)m=

(24b)

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

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

(24c)m=

(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=

(24d)

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

(25)m=

(25)

3. Thermal 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			1.89	1.8	3.402		(26)
Windows Type 1			12.84	$\times 1/[1/(1.6) + 0.04]$	19.31		(27)
Windows Type 2			5.52	$\times 1/[1/(1.6) + 0.04]$	8.3		(27)
Windows Type 3			4.18	$\times 1/[1/(1.6) + 0.04]$	6.29		(27)
Windows Type 4			0.6	$\times 1/[1/(1.6) + 0.04]$	0.9		(27)
Floor			86.82	0.17	14.7594		(28)
Walls	187.5	25.03	162.47	0.24	38.99		(29)
Roof Type1	24	0	24	0.21	5.04		(30)
Roof Type2	46.98	0	46.98	0.11	5.17		(30)
Roof Type3	0.7	0	0.7	0.2	0.14		(30)
Roof Type4	18.45	0	18.45	0.21	3.87		(30)
Total area of elements, m²			364.45				(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) = 106.17 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 21734.27 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

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

AP WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

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

13.87 (36)

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

Total fabric heat loss

(33) + (36) =

120.04 (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=	76.19	75.62	75.06	72.42	71.93	69.63	69.63	69.21	70.52	71.93	72.93	73.97

(38)

Heat transfer coefficient, W/K

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

(39)m=	196.24	195.66	195.1	192.47	191.97	189.68	189.68	189.25	190.56	191.97	192.97	194.01
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

192.46 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.34	1.33	1.33	1.31	1.31	1.29	1.29	1.29	1.3	1.31	1.31	1.32
--------	------	------	------	------	------	------	------	------	-----	------	------	------

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

1.31 (40)

Number of days in month (Table 1a)

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

(41)

4. Water heating energy requirement

kWh/year

Assumed occupancy, N

2.93

(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

103.77

(43)

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

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

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

(44)m=	114.14	109.99	105.84	101.69	97.54	93.39	93.39	97.54	101.69	105.84	109.99	114.14
--------	--------	--------	--------	--------	-------	-------	-------	-------	--------	--------	--------	--------

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

1245.21 (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=	169.27	148.05	152.77	133.19	127.8	110.28	102.19	117.27	118.67	138.29	150.96	163.93
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

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

1632.66 (45)

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

(46)m=	25.39	22.21	22.92	19.98	19.17	16.54	15.33	17.59	17.8	20.74	22.64	24.59
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

(46)

Water storage loss:

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

250

(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):

2.09

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

1.13

(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)

AP WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

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

0

(54)

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

1.13

(55)

Water storage loss calculated for each month

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

{56}m=	34.99	31.6	34.99	33.86	34.99	33.86	34.99	34.99	33.86	34.99	33.86	34.99
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

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

{57}m=	34.99	31.6	34.99	33.86	34.99	33.86	34.99	34.99	33.86	34.99	33.86	34.99
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

Primary circuit loss (annual) from Table 3

0

(58)

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

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

{59}m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (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=	227.52	200.66	211.02	189.56	186.05	166.65	160.44	175.51	175.04	196.54	207.33	222.18
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(62)

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

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

{63}m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

{64}m=	227.52	200.66	211.02	189.56	186.05	166.65	160.44	175.51	175.04	196.54	207.33	222.18
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) × 1.13

2318.5

(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=	102.88	91.32	97.4	89.38	89.09	81.76	80.58	85.59	84.55	92.58	95.29	101.11
--------	--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	--------

(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=	175.75	175.75	175.75	175.75	175.75	175.75	175.75	175.75	175.75	175.75	175.75	175.75

(66)

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

{67}m=	71.61	63.61	51.73	39.16	29.27	24.71	26.7	34.71	46.59	59.16	69.04	73.6
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

(67)

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

{68}m=	473.25	478.16	465.78	439.44	406.18	374.92	354.04	349.13	361.51	387.85	421.11	452.37
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

{69}m=	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5
--------	------	------	------	------	------	------	------	------	------	------	------	------

(69)

Pumps and fans gains (Table 5a)

{70}m=	3	3	3	3	3	3	3	3	3	3	3	3
--------	---	---	---	---	---	---	---	---	---	---	---	---

(70)

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

{71}m=	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17	-117.17
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

{72}m=	138.28	135.89	130.91	124.14	119.75	113.56	108.3	115.04	117.43	124.44	132.35	135.9
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------

(72)

Total internal gains =

$$\{66\}m + \{67\}m + \{68\}m + \{69\}m + \{70\}m + \{71\}m + \{72\}m$$

{73}m=	800.23	794.74	765.5	719.83	672.29	630.29	606.14	615.97	642.62	688.53	739.59	778.95
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains

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

SAP WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	12.84	x	10.63	x	0.63	x	0.7	=	54.19	(74)
North	0.9x	1	x	12.84	x	20.32	x	0.63	x	0.7	=	103.56	(74)
North	0.9x	1	x	12.84	x	34.53	x	0.63	x	0.7	=	175.97	(74)
North	0.9x	1	x	12.84	x	55.46	x	0.63	x	0.7	=	282.66	(74)
North	0.9x	1	x	12.84	x	74.72	x	0.63	x	0.7	=	380.77	(74)
North	0.9x	1	x	12.84	x	79.99	x	0.63	x	0.7	=	407.62	(74)
North	0.9x	1	x	12.84	x	74.68	x	0.63	x	0.7	=	380.57	(74)
North	0.9x	1	x	12.84	x	59.25	x	0.63	x	0.7	=	301.93	(74)
North	0.9x	1	x	12.84	x	41.52	x	0.63	x	0.7	=	211.58	(74)
North	0.9x	1	x	12.84	x	24.19	x	0.63	x	0.7	=	123.27	(74)
North	0.9x	1	x	12.84	x	13.12	x	0.63	x	0.7	=	66.85	(74)
North	0.9x	1	x	12.84	x	8.86	x	0.63	x	0.7	=	45.18	(74)
East	0.9x	1	x	4.18	x	19.64	x	0.63	x	0.7	=	32.58	(76)
East	0.9x	1	x	4.18	x	38.42	x	0.63	x	0.7	=	63.74	(76)
East	0.9x	1	x	4.18	x	63.27	x	0.63	x	0.7	=	104.97	(76)
East	0.9x	1	x	4.18	x	92.28	x	0.63	x	0.7	=	153.1	(76)
East	0.9x	1	x	4.18	x	113.09	x	0.63	x	0.7	=	187.63	(76)
East	0.9x	1	x	4.18	x	115.77	x	0.63	x	0.7	=	192.07	(76)
East	0.9x	1	x	4.18	x	110.22	x	0.63	x	0.7	=	182.86	(76)
East	0.9x	1	x	4.18	x	94.68	x	0.63	x	0.7	=	157.07	(76)
East	0.9x	1	x	4.18	x	73.59	x	0.63	x	0.7	=	122.09	(76)
East	0.9x	1	x	4.18	x	45.59	x	0.63	x	0.7	=	75.63	(76)
East	0.9x	1	x	4.18	x	24.49	x	0.63	x	0.7	=	40.63	(76)
East	0.9x	1	x	4.18	x	16.15	x	0.63	x	0.7	=	26.8	(76)
South	0.9x	1	x	5.52	x	46.75	x	0.63	x	0.7	=	102.43	(78)
South	0.9x	1	x	5.52	x	76.57	x	0.63	x	0.7	=	167.75	(78)
South	0.9x	1	x	5.52	x	97.53	x	0.63	x	0.7	=	213.69	(78)
South	0.9x	1	x	5.52	x	110.23	x	0.63	x	0.7	=	241.51	(78)
South	0.9x	1	x	5.52	x	114.87	x	0.63	x	0.7	=	251.67	(78)
South	0.9x	1	x	5.52	x	110.55	x	0.63	x	0.7	=	242.2	(78)
South	0.9x	1	x	5.52	x	108.01	x	0.63	x	0.7	=	236.64	(78)
South	0.9x	1	x	5.52	x	104.89	x	0.63	x	0.7	=	229.81	(78)
South	0.9x	1	x	5.52	x	101.89	x	0.63	x	0.7	=	223.22	(78)
South	0.9x	1	x	5.52	x	82.59	x	0.63	x	0.7	=	180.94	(78)
South	0.9x	1	x	5.52	x	55.42	x	0.63	x	0.7	=	121.41	(78)
South	0.9x	1	x	5.52	x	40.4	x	0.63	x	0.7	=	88.51	(78)
West	0.9x	1	x	0.6	x	19.64	x	0.63	x	0.7	=	4.68	(80)
West	0.9x	1	x	0.6	x	38.42	x	0.63	x	0.7	=	9.15	(80)
West	0.9x	1	x	0.6	x	63.27	x	0.63	x	0.7	=	15.07	(80)

SAP WorkSheet: New dwelling design stage

West	0.9x	1	x	0.6	x	92.28	x	0.63	x	0.7	=	21.98	(80)
West	0.9x	1	x	0.6	x	113.09	x	0.63	x	0.7	=	26.93	(80)
West	0.9x	1	x	0.6	x	115.77	x	0.63	x	0.7	=	27.57	(80)
West	0.9x	1	x	0.6	x	110.22	x	0.63	x	0.7	=	26.25	(80)
West	0.9x	1	x	0.6	x	94.68	x	0.63	x	0.7	=	22.55	(80)
West	0.9x	1	x	0.6	x	73.59	x	0.63	x	0.7	=	17.52	(80)
West	0.9x	1	x	0.6	x	45.59	x	0.63	x	0.7	=	10.86	(80)
West	0.9x	1	x	0.6	x	24.49	x	0.63	x	0.7	=	5.83	(80)
West	0.9x	1	x	0.6	x	16.15	x	0.63	x	0.7	=	3.85	(80)

Solar gains in watts, calculated for each month

{63}m = Sum{74}m ... {82}m

{83}m=	193.88	344.2	509.7	699.24	846.99	869.46	826.31	711.36	574.41	390.7	234.72	164.32	(83)
--------	--------	-------	-------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

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

{84}m=	994.11	1138.94	1275.2	1419.07	1519.28	1499.74	1432.45	1327.33	1217.03	1079.23	974.31	943.28	(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=	0.96	0.94	0.91	0.86	0.76	0.63	0.51	0.55	0.74	0.88	0.94	0.96	(86)

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

{87}m=	18.9	19.11	19.46	19.92	20.35	20.66	20.79	20.77	20.52	19.98	19.37	18.86	(87)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

{88}m=	19.81	19.82	19.82	19.83	19.84	19.85	19.85	19.85	19.84	19.84	19.83	19.82	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

{89}m=	0.95	0.93	0.9	0.83	0.72	0.55	0.4	0.44	0.67	0.86	0.93	0.96	(89)
--------	------	------	-----	------	------	------	-----	------	------	------	------	------	------

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

{90}m=	17.02	17.32	17.83	18.5	19.07	19.48	19.63	19.61	19.33	18.6	17.71	16.98	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) =

0.13 (91)

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

{92}m=	17.26	17.55	18.04	18.69	19.24	19.63	19.78	19.76	19.48	18.78	17.93	17.23	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

{93}m=	17.26	17.55	18.04	18.69	19.24	19.63	19.78	19.76	19.48	18.78	17.93	17.23	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

{94}m=	0.93	0.91	0.87	0.8	0.69	0.54	0.39	0.43	0.65	0.83	0.91	0.94	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

{95}m=	926.96	1035.35	1109.35	1133.81	1048.46	808.06	558.3	575.98	785.82	890.45	884.94	885.82	(95)
--------	--------	---------	---------	---------	---------	--------	-------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

{97}m=	2543.92	2476.06	2251.78	1883.38	1447.89	954.79	603.14	635.87	1026.05	1570.28	2089.49	2527.12	(97)
--------	---------	---------	---------	---------	---------	--------	--------	--------	---------	---------	---------	---------	------

SAP WorkSheet: New dwelling design stage

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

(98)m=	1203.02	968.15	849.97	539.7	297.17	0	0	0	0	505.79	867.27	1221.12	
Total per year (kWh/year) = $\text{Sum}(98)_{1..12} =$													6452.21 (98)

Space heating requirement in kWh/m²/year

43.94 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0 (201)
Fraction of space heat from main system(s) (202) = $1 - (201) =$	1 (202)
Fraction of total heating from main system 1 (204) = $(202) \times [1 - (203)] =$	1 (204)
Efficiency of main space heating system 1	249.9 (206)
Efficiency of secondary/supplementary heating system, %	0 (208)

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

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

481.4	387.42	340.12	215.96	118.92	0	0	0	0	202.4	347.05	488.65		
Total (kWh/year) =Sum(211) _{1..5,10...12} =												2581.92	(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	0	
Total (kWh/year) = $\text{Sum}(215)_{1..12} =$													0 (215)

Water heating

Output from water heater (calculated above)

	227.52	200.66	211.02	189.56	186.05	166.65	160.44	175.51	175.04	196.54	207.33	222.18		
Efficiency of water heater													175.1	(216)
(217)m=	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	(217)	

Fuel for water heating, kWh/month

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

(219)m=	129.94	114.6	120.51	108.26	106.25	95.17	91.63	100.24	99.96	112.25	118.41	126.89	
Total = $\text{Sum}(219a)_{1..12} =$													1324.1 (219)

Annual totals

Space heating fuel used, main system 1	2581.92
Water heating fuel used	1324.1

Electricity for pumps, fans and electric keep-hot

central heating pump: 30 (230c)

Total electricity for the above, kWh/year sum of (230a)...(230g) = 30 (231)

Electricity for lighting 505.88 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 4441.9 (338)

10a. Fuel costs - Individual heating systems

Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
------------------	--------------------------	---------------------

SAP WorkSheet: New dwelling design stage

Space heating - main system 1	{211} x	13.19	x 0.01 =	340.55	{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 cost (other fuel)	{219}	13.19	x 0.01 =	174.65	{247}
Pumps, fans and electric keep-hot	{231}	13.19	x 0.01 =	3.96	{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 =	66.73	{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) = 585.89 {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] =	1.28	{257}
SAP rating (Section 12)		82.11	{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	=	1340.01	{261}
Space heating (secondary)	{215} x	0.519	=	0	{263}
Water heating	{219} x	0.519	=	687.21	{264}
Space and water heating	{261} + {262} + {263} + {264} =			2027.22	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	0.519	=	15.57	{267}
Electricity for lighting	{232} x	0.519	=	262.55	{268}
Total CO2, kg/year		sum of (265) ... (271) =		2305.34	{272}
CO2 emissions per m²		(272) ÷ (4) =		15.7	{273}
EI rating (section 14)				84	{274}

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	{211} x	3.07	=	7926.48	{261}
Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	4064.99	{264}
Space and water heating	{261} + {262} + {263} + {264} =			11991.47	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	92.1	{267}
Electricity for lighting	{232} x	0	=	1553.05	{268}
'Total Primary Energy		sum of (265) ... (271) =		13636.62	{272}



FSAP WorkSheet: New dwelling design stage

Primary energy kWh/m²/year

{272} ÷ {4} =

92.86

{273}