Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
Printed on 25 March 2019 at 14:44:59

Project Information:

Assessed By: Aymon Winter (STRO014511) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 65.64m²

Site Reference : 49-51 Beulah Hill **Plot Reference:** 01-19-73120 B-2-08 PL1

Address : B-2-08, 49-51 Beulah Hill

Sada Unit Ref: B2-A18

Client Details:

Name: Sada Architecture

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: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	16.92 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.15 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	42.3 kWh/m²	
		Fail

Excess energy = 1.63 kg/m² (04.0 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (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: Database: (rev 440, product index 017558):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Worcester
Model: Greenstar
Model qualifier: 34CDi Classic ErP
(Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 % OK

Regulations Compliance Report

Secondary heating system:	None		

5 Cylinder insulation

Hot water Storage:	No cylinder		

6 Controls

Space heating controls	Programmer, room thermostat and TRVs		OK
Hot water controls:	No cylinder		
	No cylinder		
Boiler interlock:	Yes		OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system		
Specific fan power:	0.15	
Maximum	0.7	OK

9 Summertime temperature

Overheating risk (Thames valley):	Medium	OK

Based on:

Overshading:	Average or unknown
Windows facing: South East	6.12m²
Windows facing: South East	5.63m²
Windows facing: South West	4.09m²
Windows facing: North West	2.05m²
Windows facing: North East	1.28m²
Ventilation rate:	4.00
Blinds/curtains:	Closed 100% of daylight hours

10 Key features

External Walls U-value	0.13 W/m²K
Party Walls U-value	0 W/m²K
Photovoltaic array	

Code for Sustainable Homes Report
For use with Nov 2010 addendum 2014 England

STROMA BUILT ENVIRONMENT

Assessor and House Details

Assessor Name: Aymon Winter

Assessor Number: STRO014511

Property Address: B-2-08
49-51 Beulah Hill

Buiding regulation assessment

	kg/m²/year
TER	16.92
DER	12.15

ENE 1 Assessment - Dwelling Emission Rate

Total Energy Type CO_2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2012 DER Worksheet		12.15	*(ZC1)*
TER		16.92	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		12.15	
% improvement DER/TER	28.2		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	12.15	*(ZC1)*
CO2 emissions from appliances, equation (L14)	17.34	*(ZC2)*
CO2 emissions from cooking, equation (L16)	3.14	*(ZC3)*
Net CO2 emissions	36.7	*(ZC8)*

Result:

Credits awarded for ENE 1 = 3.7

Code Level = 4

ENE 2 - Fabric energy Efficiency

Fabric energy Efficiency: 42.33

Credits awarded for ENE 2 = 5.3

ENE 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		39.08
Standard DER		19.68
Actual Case CO2 emissions		33.18
Actual DER		13.78
Reduction in CO2 emissions	15.1	

Credits awarded for ENE 7 = 2

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.
It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

Predicted Energy Assessment

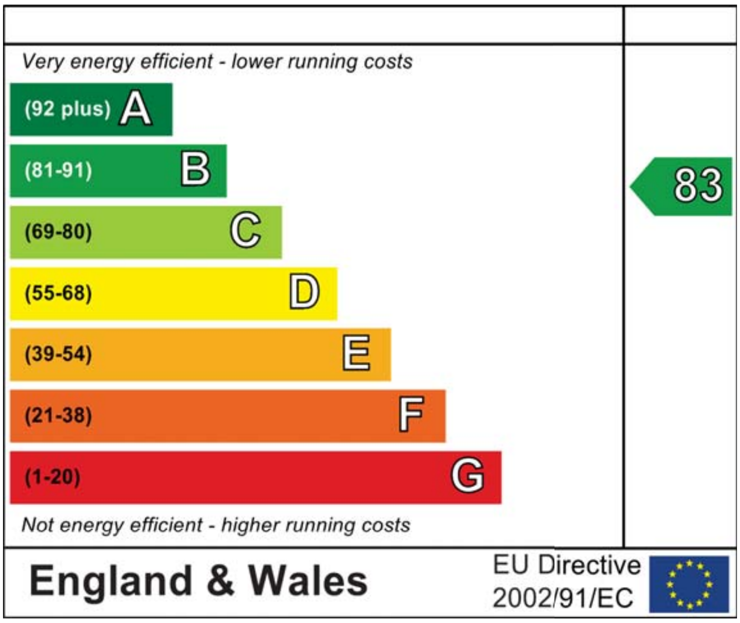
B-2-08
49-51 Beulah Hill
Sada Unit Ref: B2-A18

Dwelling type: Mid floor Flat
Date of assessment: 12 March 2019
Produced by: Aymon Winter
Total floor area: 65.64 m²

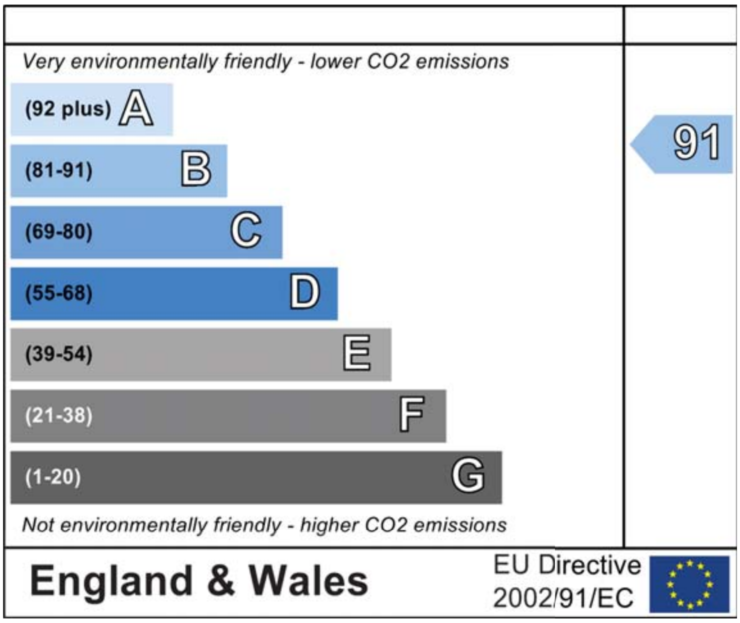
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



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

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

SAP Input

Property Details: 01-19-73120 B-2-08 PL1

Address:	B-2-08, 49-51 Beulah Hill
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	12 March 2019
Date of certificate:	25 March 2019
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Calculated 105.02
Water use <= 125 litres/person/day:	True
PCDF Version:	440

Property description:

Dwelling type:	Flat	
Detachment:		
Year Completed:	2013	
Floor Location:	**Floor area:**	**Storey height:**
Floor 0	65.64 m²	2.56 m
Living area:	27.16 m² (fraction 0.414)	
Front of dwelling faces:	North West	

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Solid			PVC-U
Rear Elev	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Metal
Rear Elev Cladding	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Metal
Side Elev	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Metal
Side Elev Cladding	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Metal
Front Elev	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Metal

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	mm	0.7	0	1.4	2.12	1
Rear Elev	16mm or more	0.8	0.4	1.4	6.12	1
Rear Elev Cladding	16mm or more	0.8	0.4	1.4	5.63	1
Side Elev	16mm or more	0.8	0.4	1.4	4.09	1
Side Elev Cladding	16mm or more	0.8	0.4	1.4	2.05	1
Front Elev	16mm or more	0.8	0.4	1.4	1.28	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall to Corridor	North West	0	0
Rear Elev		External Wall	South East	0	0
Rear Elev Cladding		External Wall Cladding	South East	0	0
Side Elev		External Wall	South West	0	0
Side Elev Cladding		External Wall Cladding	North West	0	0
Front Elev		External Wall Cladding	North East	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>							
External Wall	27.03	10.21	16.82	0.13	0	False	14
Wall to Corridor	4.99	2.12	2.87	0.26	0.43	False	14
External Wall Cladding	20.61	8.96	11.65	0.2	0	False	14

Roof to Terrace	5.51	0	5.51	0.14	0	9
Internal Elements						
IW	137.45					9
Party Elements						
Party Wall	36.92					20
Party Ceiling	60.13					30
Party Floor	65.64					40

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1977

Length	Psi-value		
9.42	0.3	E2	Other lintels (including other steel lintels)
6.59	0.04	E3	Sill
40.48	0.05	E4	Jamb
37.78	0.07	E7	Party floor between dwellings (in blocks of flats)
4.99	0.24	E24	Eaves (insulation at ceiling level - inverted)
3.34	0.28	E15	Flat roof with parapet
10.24	0.09	E16	Corner (normal)
5.12	-0.09	E17	Corner (inverted – internal area greater than external area)
2.56	0.06	E18	Party wall between dwellings
7.68	0.12	E25	Staggered party wall between dwellings c
27.19	0	P3	Intermediate floor between dwellings (in blocks of flats)
1.65	0.04	P5	Roof (insulation at rafter level)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Centralised whole house extract Number of wet rooms: Kitchen + 2 Ductwork: , rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	5

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 440, product index 017558) Efficiency: Winter 86.7 % Summer: 90.0
Brand name: Worcester
Model: Greenstar
Model qualifier: 34CDi Classic ErP
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Unknown
Boiler interlock: Yes
Delayed start

Main heating Control:

Main heating Control:

Programmer, room thermostat and TRVs
Control code: 2106

Secondary heating system:

Secondary heating system: None

SAP Input

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder 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:	Photovoltaic 1 Installed Peak power: 0.98 Tilt of collector: Horizontal Overshading: None or very little Collector Orientation: South
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Aymon Winter	**Stroma Number:**	STRO014511
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: 01-19-73120 B-2-08 PL1

Address : B-2-08, 49-51 Beulah Hill

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	65.64	(1a) x	2.56	(2a) =	168.04	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.64	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	168.04	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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							0	x 10 =	0	(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) =	0	÷ (5) =	0	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.21	(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

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

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

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

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

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

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

(24c)m=	0.52	0.52	0.51	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.52	0.52	0.51	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.4	=	2.968			(26)
Windows Type 1			6.12	x1/[1/(1.4)+ 0.04]		=	8.11			(27)
Windows Type 2			5.63	x1/[1/(1.4)+ 0.04]		=	7.46			(27)
Windows Type 3			4.09	x1/[1/(1.4)+ 0.04]		=	5.42			(27)
Windows Type 4			2.05	x1/[1/(1.4)+ 0.04]		=	2.72			(27)
Windows Type 5			1.28	x1/[1/(1.4)+ 0.04]		=	1.7			(27)
Walls Type1	27.03	10.21	16.82	x	0.13	=	2.19	14	235.48	(29)
Walls Type2	4.99	2.12	2.87	x	0.23	=	0.67	14	40.18	(29)
Walls Type3	20.61	8.96	11.65	x	0.2	=	2.33	14	163.1	(29)
Roof	5.51	0	5.51	x	0.14	=	0.77	9	49.59	(30)
Total area of elements, m²			58.14							(31)
Party wall			36.92	x	0	=	0	20	738.4	(32)
Party floor			65.64					40	2625.6	(32a)
Party ceiling			60.13					30	1803.9	(32b)
Internal wall **			137.45					9	1237.05	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6893.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 105.02 (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 | 11.49 | (36)

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

Total fabric heat loss (33) + (36) = | 45.83 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.89	28.59	28.3	27.73	27.73	27.73	27.73	27.73	27.73	27.73	27.73	27.73	(38)

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

(39)m=	74.72	74.43	74.13	73.56	73.56	73.56	73.56	73.56	73.56	73.56	73.56	73.56

Average = $Sum(39)_{1...12}$ /12= | 73.78 | (39)

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

(40)m=	1.14	1.13	1.13	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12

Average = $Sum(40)_{1...12}$ /12= | 1.12 | (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 | 2.14 | (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 | 84.93 | (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	93.42	90.02	86.62	83.23	79.83	76.43	76.43	79.83	83.23	86.62	90.02	93.42

Total = $Sum(44)_{1...12}$ = | 1019.11 | (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=	138.54	121.16	125.03	109.01	104.59	90.26	83.64	95.97	97.12	113.18	123.55	134.17

Total = $Sum(45)_{1...12}$ = | 1336.21 | (45)

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

(46)m=	20.78	18.17	18.75	16.35	15.69	13.54	12.55	14.4	14.57	16.98	18.53	20.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (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): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

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

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

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

Primary circuit loss (annual) from Table 3 | 0 | (58)

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

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

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

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

(61)m=	35.75	32.26	35.67	34.46	35.57	34.38	35.5	35.55	34.43	35.63	34.54	35.73	(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=	174.28	153.42	160.7	143.47	140.17	124.64	119.13	131.52	131.54	148.81	158.09	169.9	(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=	174.28	153.42	160.7	143.47	140.17	124.64	119.13	131.52	131.54	148.81	158.09	169.9	

Output from water heater (annual)$_{1…12}$ | 1755.67 | (64)

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

(65)m=	55	48.35	50.49	44.86	43.67	38.61	36.68	40.8	40.9	46.54	49.71	53.54	(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=	128.15	128.15	128.15	128.15	128.15	128.15	128.15	128.15	128.15	128.15	128.15	128.15	(66)

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

(67)m=	41.66	37	30.09	22.78	17.03	14.38	15.53	20.19	27.1	34.41	40.16	42.82	(67)

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

(68)m=	278.98	281.87	274.58	259.05	239.44	221.02	208.71	205.81	213.11	228.64	248.24	266.67	(68)

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

(69)m=	49.95	49.95	49.95	49.95	49.95	49.95	49.95	49.95	49.95	49.95	49.95	49.95	(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=	-85.43	-85.43	-85.43	-85.43	-85.43	-85.43	-85.43	-85.43	-85.43	-85.43	-85.43	-85.43	(71)

Water heating gains (Table 5)

(72)m=	73.92	71.95	67.86	62.31	58.7	53.62	49.31	54.84	56.8	62.55	69.05	71.97	(72)

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

(73)m=	490.23	486.49	468.2	439.8	410.84	384.68	369.22	376.51	392.68	421.27	453.12	477.12	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	1.28	x	11.28	x	0.4	x	0.8	=	3.2	(75)
Northeast	0.9x	0.77	x	1.28	x	22.97	x	0.4	x	0.8	=	6.52	(75)
Northeast	0.9x	0.77	x	1.28	x	41.38	x	0.4	x	0.8	=	11.75	(75)
Northeast	0.9x	0.77	x	1.28	x	67.96	x	0.4	x	0.8	=	19.29	(75)
Northeast	0.9x	0.77	x	1.28	x	91.35	x	0.4	x	0.8	=	25.93	(75)
Northeast	0.9x	0.77	x	1.28	x	97.38	x	0.4	x	0.8	=	27.64	(75)
Northeast	0.9x	0.77	x	1.28	x	91.1	x	0.4	x	0.8	=	25.86	(75)
Northeast	0.9x	0.77	x	1.28	x	72.63	x	0.4	x	0.8	=	20.62	(75)
Northeast	0.9x	0.77	x	1.28	x	50.42	x	0.4	x	0.8	=	14.31	(75)
Northeast	0.9x	0.77	x	1.28	x	28.07	x	0.4	x	0.8	=	7.97	(75)
Northeast	0.9x	0.77	x	1.28	x	14.2	x	0.4	x	0.8	=	4.03	(75)
Northeast	0.9x	0.77	x	1.28	x	9.21	x	0.4	x	0.8	=	2.62	(75)
Southeast	0.9x	0.77	x	6.12	x	36.79	x	0.4	x	0.8	=	49.94	(77)
Southeast	0.9x	0.77	x	5.63	x	36.79	x	0.4	x	0.8	=	45.94	(77)
Southeast	0.9x	0.77	x	6.12	x	62.67	x	0.4	x	0.8	=	85.06	(77)
Southeast	0.9x	0.77	x	5.63	x	62.67	x	0.4	x	0.8	=	78.25	(77)
Southeast	0.9x	0.77	x	6.12	x	85.75	x	0.4	x	0.8	=	116.38	(77)
Southeast	0.9x	0.77	x	5.63	x	85.75	x	0.4	x	0.8	=	107.06	(77)
Southeast	0.9x	0.77	x	6.12	x	106.25	x	0.4	x	0.8	=	144.2	(77)
Southeast	0.9x	0.77	x	5.63	x	106.25	x	0.4	x	0.8	=	132.66	(77)
Southeast	0.9x	0.77	x	6.12	x	119.01	x	0.4	x	0.8	=	161.52	(77)
Southeast	0.9x	0.77	x	5.63	x	119.01	x	0.4	x	0.8	=	148.59	(77)
Southeast	0.9x	0.77	x	6.12	x	118.15	x	0.4	x	0.8	=	160.35	(77)
Southeast	0.9x	0.77	x	5.63	x	118.15	x	0.4	x	0.8	=	147.51	(77)
Southeast	0.9x	0.77	x	6.12	x	113.91	x	0.4	x	0.8	=	154.59	(77)
Southeast	0.9x	0.77	x	5.63	x	113.91	x	0.4	x	0.8	=	142.22	(77)
Southeast	0.9x	0.77	x	6.12	x	104.39	x	0.4	x	0.8	=	141.68	(77)
Southeast	0.9x	0.77	x	5.63	x	104.39	x	0.4	x	0.8	=	130.33	(77)
Southeast	0.9x	0.77	x	6.12	x	92.85	x	0.4	x	0.8	=	126.02	(77)
Southeast	0.9x	0.77	x	5.63	x	92.85	x	0.4	x	0.8	=	115.93	(77)
Southeast	0.9x	0.77	x	6.12	x	69.27	x	0.4	x	0.8	=	94.01	(77)
Southeast	0.9x	0.77	x	5.63	x	69.27	x	0.4	x	0.8	=	86.48	(77)
Southeast	0.9x	0.77	x	6.12	x	44.07	x	0.4	x	0.8	=	59.81	(77)
Southeast	0.9x	0.77	x	5.63	x	44.07	x	0.4	x	0.8	=	55.02	(77)
Southeast	0.9x	0.77	x	6.12	x	31.49	x	0.4	x	0.8	=	42.73	(77)
Southeast	0.9x	0.77	x	5.63	x	31.49	x	0.4	x	0.8	=	39.31	(77)
Southwest	0.9x	0.77	x	4.09	x	36.79		0.4	x	0.8	=	33.37	(79)
Southwest	0.9x	0.77	x	4.09	x	62.67		0.4	x	0.8	=	56.84	(79)
Southwest	0.9x	0.77	x	4.09	x	85.75		0.4	x	0.8	=	77.78	(79)

Southwest 0.9x	0.77	x	4.09	x	106.25		0.4	x	0.8	=	96.37	(79)
Southwest 0.9x	0.77	x	4.09	x	119.01		0.4	x	0.8	=	107.94	(79)
Southwest 0.9x	0.77	x	4.09	x	118.15		0.4	x	0.8	=	107.16	(79)
Southwest 0.9x	0.77	x	4.09	x	113.91		0.4	x	0.8	=	103.32	(79)
Southwest 0.9x	0.77	x	4.09	x	104.39		0.4	x	0.8	=	94.68	(79)
Southwest 0.9x	0.77	x	4.09	x	92.85		0.4	x	0.8	=	84.22	(79)
Southwest 0.9x	0.77	x	4.09	x	69.27		0.4	x	0.8	=	62.83	(79)
Southwest 0.9x	0.77	x	4.09	x	44.07		0.4	x	0.8	=	39.97	(79)
Southwest 0.9x	0.77	x	4.09	x	31.49		0.4	x	0.8	=	28.56	(79)
Northwest 0.9x	0.77	x	2.05	x	11.28	x	0.4	x	0.8	=	5.13	(81)
Northwest 0.9x	0.77	x	2.05	x	22.97	x	0.4	x	0.8	=	10.44	(81)
Northwest 0.9x	0.77	x	2.05	x	41.38	x	0.4	x	0.8	=	18.81	(81)
Northwest 0.9x	0.77	x	2.05	x	67.96	x	0.4	x	0.8	=	30.89	(81)
Northwest 0.9x	0.77	x	2.05	x	91.35	x	0.4	x	0.8	=	41.53	(81)
Northwest 0.9x	0.77	x	2.05	x	97.38	x	0.4	x	0.8	=	44.27	(81)
Northwest 0.9x	0.77	x	2.05	x	91.1	x	0.4	x	0.8	=	41.42	(81)
Northwest 0.9x	0.77	x	2.05	x	72.63	x	0.4	x	0.8	=	33.02	(81)
Northwest 0.9x	0.77	x	2.05	x	50.42	x	0.4	x	0.8	=	22.92	(81)
Northwest 0.9x	0.77	x	2.05	x	28.07	x	0.4	x	0.8	=	12.76	(81)
Northwest 0.9x	0.77	x	2.05	x	14.2	x	0.4	x	0.8	=	6.45	(81)
Northwest 0.9x	0.77	x	2.05	x	9.21	x	0.4	x	0.8	=	4.19	(81)

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

(83)m=	137.58	237.11	331.78	423.41	485.5	486.94	467.4	420.32	363.39	264.04	165.29	117.41	(83)

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

(84)m=	627.81	723.61	799.98	863.21	896.34	871.62	836.62	796.83	756.07	685.31	618.41	594.53	(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=	0.92	0.88	0.83	0.74	0.63	0.49	0.37	0.4	0.58	0.77	0.88	0.93	(86)

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

(87)m=	19.22	19.51	19.9	20.34	20.68	20.88	20.96	20.95	20.81	20.37	19.73	19.17	(87)

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

(88)m=	19.97	19.97	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	(88)

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

(89)m=	0.9	0.87	0.81	0.71	0.58	0.42	0.29	0.32	0.51	0.73	0.86	0.91	(89)

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

(90)m=	18.37	18.66	19.04	19.45	19.75	19.91	19.97	19.96	19.86	19.49	18.88	18.34	(90)

fLA = Living area ÷ (4) = | 0.41 | (91)

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

(92)m=	18.72	19.01	19.39	19.81	20.13	20.31	20.38	20.37	20.25	19.85	19.23	18.68	(92)

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

(93)m=	18.57	18.86	19.24	19.66	19.98	20.16	20.23	20.22	20.1	19.7	19.08	18.53	(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=	0.89	0.85	0.79	0.7	0.58	0.44	0.31	0.34	0.52	0.72	0.85	0.9	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	556.28	612.34	631.11	604.23	520.31	380.1	258.75	270.22	392.83	495.95	523.02	533.21	(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=	1066.31	1039.03	944.8	791.88	609.15	409.29	266.85	280.95	441.55	669.5	881.36	1054.25	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	379.46	286.74	233.38	135.11	66.1	0	0	0	0	129.12	258.01	387.66	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1875.58 (98)

Space heating requirement in kWh/m²/year 28.57 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90	(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)													
	379.46	286.74	233.38	135.11	66.1	0	0	0	0	129.12	258.01	387.66	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	421.62	318.6	259.31	150.12	73.45	0	0	0	0	143.47	286.68	430.73	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2083.98 (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	0

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

Water heating

Output from water heater (calculated above)

	174.28	153.42	160.7	143.47	140.17	124.64	119.13	131.52	131.54	148.81	158.09	169.9

Efficiency of water heater 86.7 (216)

(217)m=	88.93	88.82	88.62	88.27	87.73	86.7	86.7	86.7	86.7	88.2	88.72	88.97	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.97	172.73	181.32	162.53	159.77	143.76	137.41	151.69	151.72	168.72	178.19	190.96

Total = Sum(219a)$_{1...12}$ = 1994.78 (219)

SAP WorkSheet: New dwelling design stage

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			2083.98	
Water heating fuel used			1994.78	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		43.05		(230a)
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		118.05	(231)
Electricity for lighting			294.29	(232)
Electricity generated by PVs			-745.28	(233)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	72.52	(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)	3.48	x 0.01 =	69.42	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	15.57	(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 =	38.82	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	0	(252)

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

Total energy cost	(245)...(247) + (250)…(254) =	316.33	(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] =	1.2	(257)
SAP rating (Section 12)		83.25	(258)

12a. CO_2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	450.14	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	430.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =			881.01	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	61.27	(267)

Electricity for lighting	(232) x	0.519	=	152.73	(268)
Energy saving/generation technologies Item 1		0.519	=	-386.8	(269)
Total CO2, kg/year	sum of (265)…(271) =			708.21	(272)
CO2 emissions per m²	(272) ÷ (4) =			10.79	(273)
EI rating (section 14)				91	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	2542.45	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2433.63	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4976.09	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	362.42	(267)
Electricity for lighting	(232) x	0	=	903.46	(268)
Energy saving/generation technologies Item 1		3.07	=	-2288.02	(269)
‘Total Primary Energy	sum of (265)…(271) =			3953.94	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			60.24	(273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 March 2019

Property Details: 01-19-73120 B-2-08 PL1

Dwelling type:	Flat
Located in:	England
Region:	Thames valley
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Calculated 105.02
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	221.81	**(P1)**
Transmission heat loss coefficient:	45.8	
Summer heat loss coefficient:	267.65	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (Rear Elev)	0	1
South East (Rear Elev Cladding)	0	1
South West (Side Elev)	0	1
North West (Side Elev Cladding)	0	1
North East (Front Elev)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (Rear Elev)	1	0.9	1	0.9	**(P8)**
South East (Rear Elev Cladding)	1	0.9	1	0.9	**(P8)**
South West (Side Elev)	1	0.9	1	0.9	**(P8)**
North West (Side Elev Cladding)	1	0.9	1	0.9	**(P8)**
North East (Front Elev)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (Rear Elev)	0.9 x	6.12	119.92	0.4	0.8	0.9	190.23	
South East (Rear Elev Cladding)	0.9 x	5.63	119.92	0.4	0.8	0.9	175	
South West (Side Elev)	0.9 x	4.09	119.92	0.4	0.8	0.9	127.13	
North West (Side Elev Cladding)	0.9 x	2.05	98.85	0.4	0.8	0.9	52.52	
North East (Front Elev)	0.9 x	1.28	98.85	0.4	0.8	0.9	32.79	
						Total	577.69	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	381.68	366.22	373.51	
Total summer gains	990.65	943.9	902.63	**(P5)**
Summer gain/loss ratio	3.7	3.53	3.37	**(P6)**
Mean summer external temperature (Thames valley)	16	17.9	17.8	

SAP 2012 Overheating Assessment

Thermal mass temperature increment	1.26	1.26	1.26	
Threshold temperature	20.97	22.69	22.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium