Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.52
Printed on 20 July 2022 at 11:26:16

Project Information:

Assessed By: Colin Marshall (STRO004020) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 40.25m²

Site Reference : Upper Bognor Road, Bognor **Plot Reference:** AC-10-05 SAP Design -new build

Address : Flat 1 , 65-71 Upper Bognor Road, BOGNOR REGIS, PO21 1HR

Client Details:

Name: Sloane and Brown

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)	33.58 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	24.06 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	56.9 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.30 (max. 0.70)	**OK**
Party wall	0.20 (max. 0.20)	-	**OK**
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	**OK**
Roof	0.17 (max. 0.20)	0.18 (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	4.00 (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:	Room heaters - wood Closed room heater Efficiency 65.0 % Minimum 65.0 %	**OK**

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.60 kWh/day Permitted by DBSCG: 1.89 kWh/day	**OK**

Regulations Compliance Report

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**

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North	1.91m²
Windows facing: South	3.05m²
Windows facing: East	1.64m²
Roof windows facing: North	0.65m²
Roof windows facing: South	0.65m²
Ventilation rate:	4.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Thermal bridging	0.027 W/m²K
Floors U-value	0.12 W/m²K
Secondary heating (wood logs)	
Secondary heating fuel wood logs	

SAP Input

Property Details: AC-10-05 SAP Design -new build

Address:	Flat 1 , 65-71 Upper Bognor Road, BOGNOR REGIS, PO21 1HR
Located in:	England
Region:	South East England
UPRN:	UPRN-508163177273
Date of assessment:	10 May 2022
Date of certificate:	20 July 2022
Assessment type:	New dwelling design stage
Transaction type:	Not sale or rental
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	502

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	40.25 m²	2.68 m

Living area:	21 m² (fraction 0.522)
Front of dwelling faces:	West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
D- exisitng	Manufacturer	Solid			Wood
new W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
new W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
new W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
RL	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood
RL	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
D- exisitng	mm	0.7	0	1.4	1.89	1
new W	16mm or more	0.8	0.63	1.4	1.91	1
new W	16mm or more	0.8	0.63	1.4	3.05	1
new W	16mm or more	0.8	0.63	1.4	1.64	1
RL	16mm or more	0.7	0.63	1.4	0.65	1
RL	16mm or more	0.7	0.63	1.4	0.65	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
D- exisitng		common party	East	0	0
new W		ext wall	North	0	0
new W		ext wall	South	0	0
new W		ext wall	East	0	0
RL		sloping	North	0.001	0
RL		sloping	South	0.001	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
ext wall	46.8	6.6	40.2	0.21	0	False	N/A
common party	3.75	1.89	1.86	0.3	0	False	N/A

SAP Input

sloping	32	1.3	30.7	0.18	0	N/A
horiz clg	9.99	0	9.99	0.14	0	N/A
floor	40.25			0.125		N/A
Internal Elements						
Party Elements						
Flat v Flat	9.53					N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0271

Length	Psi-value		
9.1	0.395	E2	Other lintels (including other steel lintels)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Natural ventilation (extract fans)
Number of chimneys: 0
Number of open flues: 0
Number of fans: 1
Number of passive stacks: 0
Number of sides sheltered: 1
Pressure test: 4

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 <= 35°C
Underfloor heating, pipes in screed above insulation
Central heating pump : 2013 or later
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:
Room heaters
Solid fuel room heaters
Fuel :wood logs
Info Source: SAP Tables
Closed room heater
HETAS Approved

Water heating:

Water heating:
From main heating system
Water code: 901
Fuel :Electricity
Hot water cylinder
Cylinder volume: 150 litres
Cylinder insulation: Measured loss, 1.6kWh/day
Primary pipework insulation: True
Cylinderstat: True
Cylinder in heated space: True
Solar panel: False

SAP Input

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

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Colin Marshall	**Stroma Number:**	STRO004020
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.52

Property Address: AC-10-05 SAP Design -new build

Address : Flat 1 , 65-71 Upper Bognor Road, BOGNOR REGIS, PO21 1HR

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	40.25	(1a) x	2.68	(2a) =	107.87	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	40.25	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		107.87	(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							1	x 10 =	10	(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) =	10	÷ (5) =	0.09 (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			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.29 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
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) =		0.27 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	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

SAP WorkSheet: New dwelling design stage

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

0.35	0.34	0.33	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.3	0.32

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

(25)m=	0.56	0.56	0.56	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			1.91	x1/[1/(1.4)+ 0.04]		=	2.53			(27)
Windows Type 2			3.05	x1/[1/(1.4)+ 0.04]		=	4.04			(27)
Windows Type 3			1.64	x1/[1/(1.4)+ 0.04]		=	2.17			(27)
Rooflights Type 1			0.65	x1/[1/(1.4) + 0.04]		=	0.91			(27b)
Rooflights Type 2			0.65	x1/[1/(1.4) + 0.04]		=	0.91			(27b)
Floor			40.25	x	0.125	=	5.03125			(28)
Walls Type1	46.8	6.6	40.2	x	0.21	=	8.44			(29)
Walls Type2	3.75	1.89	1.86	x	0.3	=	0.56			(29)
Roof Type1	32	1.3	30.7	x	0.18	=	5.53			(30)
Roof Type2	9.99	0	9.99	x	0.14	=	1.4			(30)
Total area of elements, m²			132.79							(31)
Party wall			9.53	x	0.2	=	1.91			(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) = 35.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 5830.81 (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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.59 (36)

SAP WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 39.58 (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=	19.92	19.84	19.76	19.38	19.31	18.98	18.98	18.91	19.1	19.31	19.45	19.6	(38)

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

(39)m=	59.5	59.41	59.33	58.95	58.88	58.55	58.55	58.49	58.68	58.88	59.03	59.18	

Average = Sum(39)$_{1...12}$ /12= 58.95 (39)

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

(40)m=	1.48	1.48	1.47	1.46	1.46	1.45	1.45	1.45	1.46	1.46	1.47	1.47	

Average = Sum(40)$_{1...12}$ /12= 1.46 (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 1.41 (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 67.76 (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)

	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=	74.53	71.82	69.11	66.4	63.69	60.98	60.98	63.69	66.4	69.11	71.82	74.53	

Total = Sum(44)$_{1...12}$ = 813.1 (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=	110.53	96.67	99.76	86.97	83.45	72.01	66.73	76.57	77.49	90.3	98.57	107.04	

Total = Sum(45)$_{1...12}$ = 1066.11 (45)

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

(46)m=	16.58	14.5	14.96	13.05	12.52	10.8	10.01	11.49	11.62	13.55	14.79	16.06	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.86 (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) 0.86 (55)

SAP WorkSheet: New dwelling design stage

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

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	160.58	141.88	149.8	135.4	133.5	120.44	116.78	126.62	125.92	140.35	147.01	157.09	(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=	160.58	141.88	149.8	135.4	133.5	120.44	116.78	126.62	125.92	140.35	147.01	157.09	

Output from water heater (annual)$_{1...12}$ | 1655.36 | (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=	76.79	68.31	73.21	67.66	67.78	62.69	62.22	65.5	64.51	70.06	71.52	75.63	(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=	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	(66)

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

(67)m=	27.22	24.18	19.66	14.89	11.13	9.39	10.15	13.19	17.71	22.49	26.25	27.98	(67)

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

(68)m=	182.33	184.22	179.46	169.31	156.49	144.45	136.41	134.51	139.28	149.43	162.25	174.29	(68)

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

(69)m=	44.89	44.89	44.89	44.89	44.89	44.89	44.89	44.89	44.89	44.89	44.89	44.89	(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=	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	(71)

Water heating gains (Table 5)

(72)m=	103.21	101.65	98.4	93.98	91.11	87.07	83.64	88.03	89.6	94.17	99.34	101.65	(72)

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

(73)m=	388.92	386.2	373.67	354.32	334.88	317.07	306.34	311.89	322.74	342.24	363.98	380.07	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	1.91	x	10.63	x	0.63	x	0.8	=	7.09	(74)
North 0.9x	0.77	x	1.91	x	20.32	x	0.63	x	0.8	=	13.56	(74)
North 0.9x	0.77	x	1.91	x	34.53	x	0.63	x	0.8	=	23.04	(74)
North 0.9x	0.77	x	1.91	x	55.46	x	0.63	x	0.8	=	37	(74)
North 0.9x	0.77	x	1.91	x	74.72	x	0.63	x	0.8	=	49.84	(74)
North 0.9x	0.77	x	1.91	x	79.99	x	0.63	x	0.8	=	53.36	(74)
North 0.9x	0.77	x	1.91	x	74.68	x	0.63	x	0.8	=	49.82	(74)
North 0.9x	0.77	x	1.91	x	59.25	x	0.63	x	0.8	=	39.52	(74)
North 0.9x	0.77	x	1.91	x	41.52	x	0.63	x	0.8	=	27.7	(74)
North 0.9x	0.77	x	1.91	x	24.19	x	0.63	x	0.8	=	16.14	(74)
North 0.9x	0.77	x	1.91	x	13.12	x	0.63	x	0.8	=	8.75	(74)
North 0.9x	0.77	x	1.91	x	8.86	x	0.63	x	0.8	=	5.91	(74)
East 0.9x	0.77	x	1.64	x	19.64	x	0.63	x	0.8	=	11.25	(76)
East 0.9x	0.77	x	1.64	x	38.42	x	0.63	x	0.8	=	22.01	(76)
East 0.9x	0.77	x	1.64	x	63.27	x	0.63	x	0.8	=	36.24	(76)
East 0.9x	0.77	x	1.64	x	92.28	x	0.63	x	0.8	=	52.86	(76)
East 0.9x	0.77	x	1.64	x	113.09	x	0.63	x	0.8	=	64.78	(76)
East 0.9x	0.77	x	1.64	x	115.77	x	0.63	x	0.8	=	66.31	(76)
East 0.9x	0.77	x	1.64	x	110.22	x	0.63	x	0.8	=	63.13	(76)
East 0.9x	0.77	x	1.64	x	94.68	x	0.63	x	0.8	=	54.23	(76)
East 0.9x	0.77	x	1.64	x	73.59	x	0.63	x	0.8	=	42.15	(76)
East 0.9x	0.77	x	1.64	x	45.59	x	0.63	x	0.8	=	26.11	(76)
East 0.9x	0.77	x	1.64	x	24.49	x	0.63	x	0.8	=	14.03	(76)
East 0.9x	0.77	x	1.64	x	16.15	x	0.63	x	0.8	=	9.25	(76)
South 0.9x	0.77	x	3.05	x	46.75	x	0.63	x	0.8	=	49.8	(78)
South 0.9x	0.77	x	3.05	x	76.57	x	0.63	x	0.8	=	81.57	(78)
South 0.9x	0.77	x	3.05	x	97.53	x	0.63	x	0.8	=	103.9	(78)
South 0.9x	0.77	x	3.05	x	110.23	x	0.63	x	0.8	=	117.43	(78)
South 0.9x	0.77	x	3.05	x	114.87	x	0.63	x	0.8	=	122.37	(78)
South 0.9x	0.77	x	3.05	x	110.55	x	0.63	x	0.8	=	117.76	(78)
South 0.9x	0.77	x	3.05	x	108.01	x	0.63	x	0.8	=	115.06	(78)
South 0.9x	0.77	x	3.05	x	104.89	x	0.63	x	0.8	=	111.74	(78)
South 0.9x	0.77	x	3.05	x	101.89	x	0.63	x	0.8	=	108.54	(78)
South 0.9x	0.77	x	3.05	x	82.59	x	0.63	x	0.8	=	87.98	(78)
South 0.9x	0.77	x	3.05	x	55.42	x	0.63	x	0.8	=	59.03	(78)
South 0.9x	0.77	x	3.05	x	40.4	x	0.63	x	0.8	=	43.04	(78)
Rooflights 0.9x	1	x	0.65	x	18.19	x	0.63	x	0.7	=	4.69	(82)
Rooflights 0.9x	1	x	0.65	x	38.49	x	0.63	x	0.7	=	9.93	(82)
Rooflights 0.9x	1	x	0.65	x	35.61	x	0.63	x	0.7	=	9.19	(82)

SAP WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	0.65	x	72.74	x	0.63	x	0.7	=	18.77	(82)
Rooflights 0.9x	1	x	0.65	x	66	x	0.63	x	0.7	=	17.03	(82)
Rooflights 0.9x	1	x	0.65	x	115.41	x	0.63	x	0.7	=	29.77	(82)
Rooflights 0.9x	1	x	0.65	x	118.86	x	0.63	x	0.7	=	30.66	(82)
Rooflights 0.9x	1	x	0.65	x	164.44	x	0.63	x	0.7	=	42.42	(82)
Rooflights 0.9x	1	x	0.65	x	172.87	x	0.63	x	0.7	=	44.6	(82)
Rooflights 0.9x	1	x	0.65	x	200.02	x	0.63	x	0.7	=	51.6	(82)
Rooflights 0.9x	1	x	0.65	x	190.66	x	0.63	x	0.7	=	49.19	(82)
Rooflights 0.9x	1	x	0.65	x	204.54	x	0.63	x	0.7	=	52.77	(82)
Rooflights 0.9x	1	x	0.65	x	175.78	x	0.63	x	0.7	=	45.35	(82)
Rooflights 0.9x	1	x	0.65	x	194.79	x	0.63	x	0.7	=	50.25	(82)
Rooflights 0.9x	1	x	0.65	x	131.53	x	0.63	x	0.7	=	33.93	(82)
Rooflights 0.9x	1	x	0.65	x	167.99	x	0.63	x	0.7	=	43.34	(82)
Rooflights 0.9x	1	x	0.65	x	83.13	x	0.63	x	0.7	=	21.45	(82)
Rooflights 0.9x	1	x	0.65	x	132.7	x	0.63	x	0.7	=	34.23	(82)
Rooflights 0.9x	1	x	0.65	x	43.53	x	0.63	x	0.7	=	11.23	(82)
Rooflights 0.9x	1	x	0.65	x	84.98	x	0.63	x	0.7	=	21.92	(82)
Rooflights 0.9x	1	x	0.65	x	22.51	x	0.63	x	0.7	=	5.81	(82)
Rooflights 0.9x	1	x	0.65	x	47.49	x	0.63	x	0.7	=	12.25	(82)
Rooflights 0.9x	1	x	0.65	x	15.16	x	0.63	x	0.7	=	3.91	(82)
Rooflights 0.9x	1	x	0.65	x	32	x	0.63	x	0.7	=	8.26	(82)

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

(83)m=	82.77	145.08	209.98	280.38	333.19	339.39	323.61	282.77	234.07	163.38	99.87	70.37	(83)

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

(84)m=	471.69	531.28	583.64	634.7	668.07	656.46	629.96	594.66	556.81	505.62	463.85	450.44	(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=	0.89	0.86	0.81	0.73	0.62	0.49	0.38	0.41	0.58	0.76	0.86	0.9	(86)

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

(87)m=	19.17	19.39	19.73	20.14	20.49	20.72	20.82	20.8	20.63	20.19	19.62	19.12	(87)

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

(88)m=	19.7	19.71	19.71	19.71	19.72	19.72	19.72	19.72	19.72	19.72	19.71	19.71	(88)

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

(89)m=	0.88	0.84	0.79	0.7	0.57	0.41	0.28	0.31	0.5	0.71	0.84	0.89	(89)

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

(90)m=	17.33	17.64	18.11	18.68	19.13	19.42	19.51	19.5	19.33	18.77	17.97	17.26	(90)

fLA = Living area ÷ (4) = 0.52 (91)

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

SAP WorkSheet: New dwelling design stage

(92)m=	18.29	18.55	18.96	19.44	19.84	20.1	20.2	20.18	20.01	19.51	18.83	18.23	(92)

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

(93)m=	18.29	18.55	18.96	19.44	19.84	20.1	20.2	20.18	20.01	19.51	18.83	18.23	(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=	0.86	0.82	0.77	0.69	0.57	0.44	0.32	0.35	0.52	0.71	0.82	0.87	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	404.19	436.85	449.32	435.57	382.88	285.96	198.57	205.96	290.04	357.28	379.05	390.53	(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=	832.36	811.16	739.01	621.36	479.29	321.93	210.5	221.22	346.71	524.79	692.35	830.32	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	318.56	251.53	215.53	133.77	71.73	0	0	0	0	124.63	225.58	327.2	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1668.53 (98)

Space heating requirement in kWh/m²/year 41.45 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0.1 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 0.9 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 0.9 (204)

Efficiency of main space heating system 1 249.9 (206)

Efficiency of secondary/supplementary heating system, % 65 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	318.56	251.53	215.53	133.77	71.73	0	0	0	0	124.63	225.58	327.2	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	114.73	90.59	77.62	48.18	25.83	0	0	0	0	44.89	81.24	117.84	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 600.91 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	49.01	38.7	33.16	20.58	11.03	0	0	0	0	19.17	34.7	50.34	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 256.7 (215)

Water heating

Output from water heater (calculated above)

	160.58	141.88	149.8	135.4	133.5	120.44	116.78	126.62	125.92	140.35	147.01	157.09	

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 x 100 ÷ (217)m

(219)m=	91.71	81.03	85.55	77.33	76.24	68.79	66.69	72.31	71.91	80.15	83.96	89.72	

Total = Sum(219a)$_{1...12}$ = 945.38 (219)

SAP WorkSheet: New dwelling design stage

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		600.91	
Space heating fuel used, secondary		256.7	
Water heating fuel used		945.38	
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		192.3	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2025.29	(338)

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 =	79.26	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	4.23 x 0.01 =	10.86	(242)
Water heating cost (other fuel)	(219)	13.19 x 0.01 =	124.7	(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 =	25.36	(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) =		244.14	(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)	83.22	(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 =	311.87	(261)
Space heating (secondary)	(215) x	0.019 =	4.88	(263)
Water heating	(219) x	0.519 =	490.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =		807.4	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	15.57	(267)
Electricity for lighting	(232) x	0.519 =	99.8	(268)
Total CO2, kg/year	sum of (265)…(271) =		922.78	(272)

SAP WorkSheet: New dwelling design stage

CO2 emissions per m²	(272) ÷ (4) =	22.93	(273)
EI rating (section 14)		85	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1844.8	(261)
Space heating (secondary)	(215)	x	1.04	=	266.96	(263)
Energy for water heating	(219)	x	3.07	=	2902.32	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5014.08	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	92.1	(267)
Electricity for lighting	(232)	x	0	=	590.36	(268)
‘Total Primary Energy	sum of (265)…(271) =				5696.54	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				141.53	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Colin Marshall	**Stroma Number:**	STRO004020
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.52

Property Address: AC-10-05 SAP Design -new build

Address : Flat 1 , 65-71 Upper Bognor Road, BOGNOR REGIS, PO21 1HR

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	40.25	(1a) x	2.68	(2a) =	107.87	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	40.25	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		107.87	(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							1	x 10 =	10	(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) =	10	÷ (5) =	0.09 (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			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.29 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
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) =		0.27 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	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

DER WorkSheet: New dwelling design stage

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

0.35	0.34	0.33	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.3	0.32

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

(25)m=	0.56	0.56	0.56	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			1.89	x	1.4	=	2.646			(26)
Windows Type 1			1.91	x1/[1/(1.4)+ 0.04]		=	2.53			(27)
Windows Type 2			3.05	x1/[1/(1.4)+ 0.04]		=	4.04			(27)
Windows Type 3			1.64	x1/[1/(1.4)+ 0.04]		=	2.17			(27)
Rooflights Type 1			0.65	x1/[1/(1.4) + 0.04]		=	0.91			(27b)
Rooflights Type 2			0.65	x1/[1/(1.4) + 0.04]		=	0.91			(27b)
Floor			40.25	x	0.125	=	5.03125			(28)
Walls Type1	46.8	6.6	40.2	x	0.21	=	8.44			(29)
Walls Type2	3.75	1.89	1.86	x	0.3	=	0.56			(29)
Roof Type1	32	1.3	30.7	x	0.18	=	5.53			(30)
Roof Type2	9.99	0	9.99	x	0.14	=	1.4			(30)
Total area of elements, m²			132.79							(31)
Party wall			9.53	x	0.2	=	1.91			(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) = 35.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 5830.81 (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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.59 (36)

DER WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 39.58 (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=	19.92	19.84	19.76	19.38	19.31	18.98	18.98	18.91	19.1	19.31	19.45	19.6	(38)

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

(39)m=	59.5	59.41	59.33	58.95	58.88	58.55	58.55	58.49	58.68	58.88	59.03	59.18	

Average = Sum(39)$_{1...12}$ /12= 58.95 (39)

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

(40)m=	1.48	1.48	1.47	1.46	1.46	1.45	1.45	1.45	1.46	1.46	1.47	1.47	

Average = Sum(40)$_{1...12}$ /12= 1.46 (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 1.41 (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 67.76 (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)

	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=	74.53	71.82	69.11	66.4	63.69	60.98	60.98	63.69	66.4	69.11	71.82	74.53	

Total = Sum(44)$_{1...12}$ = 813.1 (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=	110.53	96.67	99.76	86.97	83.45	72.01	66.73	76.57	77.49	90.3	98.57	107.04	

Total = Sum(45)$_{1...12}$ = 1066.11 (45)

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

(46)m=	16.58	14.5	14.96	13.05	12.52	10.8	10.01	11.49	11.62	13.55	14.79	16.06	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.86 (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) 0.86 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	160.58	141.88	149.8	135.4	133.5	120.44	116.78	126.62	125.92	140.35	147.01	157.09	(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=	160.58	141.88	149.8	135.4	133.5	120.44	116.78	126.62	125.92	140.35	147.01	157.09	

Output from water heater (annual)$_{1...12}$ | 1655.36 | (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=	76.79	68.31	73.21	67.66	67.78	62.69	62.22	65.5	64.51	70.06	71.52	75.63	(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=	70.65	70.65	70.65	70.65	70.65	70.65	70.65	70.65	70.65	70.65	70.65	70.65	(66)

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

(67)m=	10.89	9.67	7.87	5.95	4.45	3.76	4.06	5.28	7.08	8.99	10.5	11.19	(67)

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

(68)m=	122.16	123.43	120.24	113.44	104.85	96.78	91.39	90.12	93.32	100.12	108.7	116.77	(68)

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

(69)m=	30.06	30.06	30.06	30.06	30.06	30.06	30.06	30.06	30.06	30.06	30.06	30.06	(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=	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	(71)

Water heating gains (Table 5)

(72)m=	103.21	101.65	98.4	93.98	91.11	87.07	83.64	88.03	89.6	94.17	99.34	101.65	(72)

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

(73)m=	283.46	281.94	273.69	260.56	247.6	234.8	226.28	230.63	237.2	250.48	265.73	276.81	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.91	x	10.63	x	0.63	x	0.8	=	7.09	(74)
North	0.9x 0.77	x	1.91	x	20.32	x	0.63	x	0.8	=	13.56	(74)
North	0.9x 0.77	x	1.91	x	34.53	x	0.63	x	0.8	=	23.04	(74)
North	0.9x 0.77	x	1.91	x	55.46	x	0.63	x	0.8	=	37	(74)
North	0.9x 0.77	x	1.91	x	74.72	x	0.63	x	0.8	=	49.84	(74)
North	0.9x 0.77	x	1.91	x	79.99	x	0.63	x	0.8	=	53.36	(74)
North	0.9x 0.77	x	1.91	x	74.68	x	0.63	x	0.8	=	49.82	(74)
North	0.9x 0.77	x	1.91	x	59.25	x	0.63	x	0.8	=	39.52	(74)
North	0.9x 0.77	x	1.91	x	41.52	x	0.63	x	0.8	=	27.7	(74)
North	0.9x 0.77	x	1.91	x	24.19	x	0.63	x	0.8	=	16.14	(74)
North	0.9x 0.77	x	1.91	x	13.12	x	0.63	x	0.8	=	8.75	(74)
North	0.9x 0.77	x	1.91	x	8.86	x	0.63	x	0.8	=	5.91	(74)
East	0.9x 0.77	x	1.64	x	19.64	x	0.63	x	0.8	=	11.25	(76)
East	0.9x 0.77	x	1.64	x	38.42	x	0.63	x	0.8	=	22.01	(76)
East	0.9x 0.77	x	1.64	x	63.27	x	0.63	x	0.8	=	36.24	(76)
East	0.9x 0.77	x	1.64	x	92.28	x	0.63	x	0.8	=	52.86	(76)
East	0.9x 0.77	x	1.64	x	113.09	x	0.63	x	0.8	=	64.78	(76)
East	0.9x 0.77	x	1.64	x	115.77	x	0.63	x	0.8	=	66.31	(76)
East	0.9x 0.77	x	1.64	x	110.22	x	0.63	x	0.8	=	63.13	(76)
East	0.9x 0.77	x	1.64	x	94.68	x	0.63	x	0.8	=	54.23	(76)
East	0.9x 0.77	x	1.64	x	73.59	x	0.63	x	0.8	=	42.15	(76)
East	0.9x 0.77	x	1.64	x	45.59	x	0.63	x	0.8	=	26.11	(76)
East	0.9x 0.77	x	1.64	x	24.49	x	0.63	x	0.8	=	14.03	(76)
East	0.9x 0.77	x	1.64	x	16.15	x	0.63	x	0.8	=	9.25	(76)
South	0.9x 0.77	x	3.05	x	46.75	x	0.63	x	0.8	=	49.8	(78)
South	0.9x 0.77	x	3.05	x	76.57	x	0.63	x	0.8	=	81.57	(78)
South	0.9x 0.77	x	3.05	x	97.53	x	0.63	x	0.8	=	103.9	(78)
South	0.9x 0.77	x	3.05	x	110.23	x	0.63	x	0.8	=	117.43	(78)
South	0.9x 0.77	x	3.05	x	114.87	x	0.63	x	0.8	=	122.37	(78)
South	0.9x 0.77	x	3.05	x	110.55	x	0.63	x	0.8	=	117.76	(78)
South	0.9x 0.77	x	3.05	x	108.01	x	0.63	x	0.8	=	115.06	(78)
South	0.9x 0.77	x	3.05	x	104.89	x	0.63	x	0.8	=	111.74	(78)
South	0.9x 0.77	x	3.05	x	101.89	x	0.63	x	0.8	=	108.54	(78)
South	0.9x 0.77	x	3.05	x	82.59	x	0.63	x	0.8	=	87.98	(78)
South	0.9x 0.77	x	3.05	x	55.42	x	0.63	x	0.8	=	59.03	(78)
South	0.9x 0.77	x	3.05	x	40.4	x	0.63	x	0.8	=	43.04	(78)
Rooflights	0.9x 1	x	0.65	x	18.19	x	0.63	x	0.7	=	4.69	(82)
Rooflights	0.9x 1	x	0.65	x	38.49	x	0.63	x	0.7	=	9.93	(82)
Rooflights	0.9x 1	x	0.65	x	35.61	x	0.63	x	0.7	=	9.19	(82)

DER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	0.65	x	72.74	x	0.63	x	0.7	=	18.77	(82)
Rooflights 0.9x	1	x	0.65	x	66	x	0.63	x	0.7	=	17.03	(82)
Rooflights 0.9x	1	x	0.65	x	115.41	x	0.63	x	0.7	=	29.77	(82)
Rooflights 0.9x	1	x	0.65	x	118.86	x	0.63	x	0.7	=	30.66	(82)
Rooflights 0.9x	1	x	0.65	x	164.44	x	0.63	x	0.7	=	42.42	(82)
Rooflights 0.9x	1	x	0.65	x	172.87	x	0.63	x	0.7	=	44.6	(82)
Rooflights 0.9x	1	x	0.65	x	200.02	x	0.63	x	0.7	=	51.6	(82)
Rooflights 0.9x	1	x	0.65	x	190.66	x	0.63	x	0.7	=	49.19	(82)
Rooflights 0.9x	1	x	0.65	x	204.54	x	0.63	x	0.7	=	52.77	(82)
Rooflights 0.9x	1	x	0.65	x	175.78	x	0.63	x	0.7	=	45.35	(82)
Rooflights 0.9x	1	x	0.65	x	194.79	x	0.63	x	0.7	=	50.25	(82)
Rooflights 0.9x	1	x	0.65	x	131.53	x	0.63	x	0.7	=	33.93	(82)
Rooflights 0.9x	1	x	0.65	x	167.99	x	0.63	x	0.7	=	43.34	(82)
Rooflights 0.9x	1	x	0.65	x	83.13	x	0.63	x	0.7	=	21.45	(82)
Rooflights 0.9x	1	x	0.65	x	132.7	x	0.63	x	0.7	=	34.23	(82)
Rooflights 0.9x	1	x	0.65	x	43.53	x	0.63	x	0.7	=	11.23	(82)
Rooflights 0.9x	1	x	0.65	x	84.98	x	0.63	x	0.7	=	21.92	(82)
Rooflights 0.9x	1	x	0.65	x	22.51	x	0.63	x	0.7	=	5.81	(82)
Rooflights 0.9x	1	x	0.65	x	47.49	x	0.63	x	0.7	=	12.25	(82)
Rooflights 0.9x	1	x	0.65	x	15.16	x	0.63	x	0.7	=	3.91	(82)
Rooflights 0.9x	1	x	0.65	x	32	x	0.63	x	0.7	=	8.26	(82)

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

(83)m=	82.77	145.08	209.98	280.38	333.19	339.39	323.61	282.77	234.07	163.38	99.87	70.37	(83)

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

(84)m=	366.23	427.02	483.67	540.94	580.8	574.2	549.9	513.4	471.26	413.86	365.6	347.18	(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=	0.93	0.9	0.86	0.78	0.67	0.54	0.42	0.46	0.64	0.82	0.9	0.94	(86)

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

(87)m=	18.93	19.17	19.55	20.01	20.41	20.69	20.8	20.78	20.57	20.06	19.41	18.88	(87)

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

(88)m=	19.7	19.71	19.71	19.71	19.72	19.72	19.72	19.72	19.72	19.72	19.71	19.71	(88)

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

(89)m=	0.92	0.89	0.84	0.75	0.62	0.46	0.31	0.35	0.56	0.78	0.89	0.93	(89)

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

(90)m=	16.99	17.34	17.87	18.52	19.05	19.39	19.5	19.49	19.27	18.6	17.69	16.92	(90)

fLA = Living area ÷ (4) = 0.52 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	18	18.3	18.75	19.3	19.76	20.06	20.18	20.16	19.95	19.36	18.59	17.94	(92)

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

(93)m=	18	18.3	18.75	19.3	19.76	20.06	20.18	20.16	19.95	19.36	18.59	17.94	(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=	0.9	0.87	0.82	0.74	0.62	0.48	0.35	0.39	0.58	0.77	0.87	0.91	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	330.33	371.03	395.78	398	360.87	275.94	194.56	200.6	272.81	317	317.58	316.18	(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=	815.36	796	726.76	612.98	474.59	319.91	209.7	220.15	343.1	515.75	678.25	813.28	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	360.86	285.58	246.25	154.79	84.61	0	0	0	0	147.87	259.68	369.85	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1909.49 (98)

Space heating requirement in kWh/m²/year 47.44 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0.1 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 0.9 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 0.9 (204)

Efficiency of main space heating system 1 249.9 (206)

Efficiency of secondary/supplementary heating system, % 65 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	360.86	285.58	246.25	154.79	84.61	0	0	0	0	147.87	259.68	369.85	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	129.96	102.85	88.69	55.75	30.47	0	0	0	0	53.25	93.52	133.2	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 687.69 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	55.52	43.94	37.89	23.81	13.02	0	0	0	0	22.75	39.95	56.9	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 293.77 (215)

Water heating

Output from water heater (calculated above)

	160.58	141.88	149.8	135.4	133.5	120.44	116.78	126.62	125.92	140.35	147.01	157.09	

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 x 100 ÷ (217)m

(219)m=	91.71	81.03	85.55	77.33	76.24	68.79	66.69	72.31	71.91	80.15	83.96	89.72	

Total = Sum(219a)$_{1...12}$ = 945.38 (219)

DER WorkSheet: New dwelling design stage

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		687.69	
Space heating fuel used, secondary		293.77	
Water heating fuel used		945.38	
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		192.3	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2149.14	(338)

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 =	356.91	(261)
Space heating (secondary)	(215) x	0.019 =	5.58	(263)
Water heating	(219) x	0.519 =	490.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =		853.15	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	15.57	(267)
Electricity for lighting	(232) x	0.519 =	99.8	(268)
Total CO2, kg/year	sum of (265)…(271) =		968.52	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =		24.06	(273)
EI rating (section 14)			85	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Colin Marshall	**Stroma Number:**	STRO004020
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.52

Property Address: AC-10-05 SAP Design -new build

Address : Flat 1 , 65-71 Upper Bognor Road, BOGNOR REGIS, PO21 1HR

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	40.25	(1a) x	2.68	(2a) =	107.87	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	40.25	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		107.87	(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							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.19	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.44	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
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) =		0.4	(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

TER WorkSheet: New dwelling design stage

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

0.51	0.5	0.49	0.44	0.43	0.38	0.38	0.37	0.4	0.43	0.45	0.47

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(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	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=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(24d)

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

(25)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(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			1.89	x	1	=	1.89			(26)
Windows Type 1			1.91	x	1/[1/(1.4)+ 0.04]	=	2.53			(27)
Windows Type 2			3.05	x	1/[1/(1.4)+ 0.04]	=	4.04			(27)
Windows Type 3			1.64	x	1/[1/(1.4)+ 0.04]	=	2.17			(27)
Rooflights Type 1			0.65	x	1/[1/(1.7) + 0.04]	=	1.105			(27b)
Rooflights Type 2			0.65	x	1/[1/(1.7) + 0.04]	=	1.105			(27b)
Floor			40.25	x	0.13	=	5.2325			(28)
Walls Type1	46.8	6.6	40.2	x	0.18	=	7.24			(29)
Walls Type2	3.75	1.89	1.86	x	0.18	=	0.33			(29)
Roof Type1	32	1.3	30.7	x	0.13	=	3.99			(30)
Roof Type2	9.99	0	9.99	x	0.13	=	1.3			(30)
Total area of elements, m²			132.79							(31)
Party wall			9.53	x	0	=	0			(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) = 30.8 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 5830.81 (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 0.46 (36)

TER WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 31.26 (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=	22.49	22.31	22.13	21.29	21.13	20.4	20.4	20.27	20.69	21.13	21.45	21.78	(38)

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

(39)m=	53.75	53.57	53.39	52.55	52.39	51.66	51.66	51.53	51.94	52.39	52.71	53.04	

Average = Sum(39)$_{1...12}$ /12= 52.55 (39)

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

(40)m=	1.34	1.33	1.33	1.31	1.3	1.28	1.28	1.28	1.29	1.3	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 1.41 (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 67.76 (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)

	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=	74.53	71.82	69.11	66.4	63.69	60.98	60.98	63.69	66.4	69.11	71.82	74.53	

Total = Sum(44)$_{1...12}$ = 813.1 (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=	110.53	96.67	99.76	86.97	83.45	72.01	66.73	76.57	77.49	90.3	98.57	107.04	

Total = Sum(45)$_{1...12}$ = 1066.11 (45)

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

(46)m=	16.58	14.5	14.96	13.05	12.52	10.8	10.01	11.49	11.62	13.55	14.79	16.06	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

TER WorkSheet: New dwelling design stage

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	157.13	138.76	146.35	132.06	130.05	117.1	113.32	123.17	122.58	136.9	143.67	153.64	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	157.13	138.76	146.35	132.06	130.05	117.1	113.32	123.17	122.58	136.9	143.67	153.64	

Output from water heater (annual)$_{1...12}$ | 1614.72 | (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=	74.03	65.81	70.45	64.99	65.02	60.02	59.46	62.74	61.84	67.3	68.85	72.87	(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=	70.65	70.65	70.65	70.65	70.65	70.65	70.65	70.65	70.65	70.65	70.65	70.65	(66)

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

(67)m=	10.95	9.73	7.91	5.99	4.48	3.78	4.08	5.31	7.13	9.05	10.56	11.26	(67)

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

(68)m=	122.16	123.43	120.24	113.44	104.85	96.78	91.39	90.12	93.32	100.12	108.7	116.77	(68)

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

(69)m=	30.06	30.06	30.06	30.06	30.06	30.06	30.06	30.06	30.06	30.06	30.06	30.06	(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=	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	-56.52	(71)

Water heating gains (Table 5)

(72)m=	99.5	97.93	94.68	90.27	87.4	83.36	79.92	84.32	85.89	90.46	95.62	97.94	(72)

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

(73)m=	279.81	278.29	270.03	256.88	243.92	231.11	222.59	226.95	233.53	246.82	262.08	273.17	(73)

6. Solar gains:

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

TER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.91	x	10.63	x	0.63	x	0.7	=	6.21	(74)
North	0.9x	0.77	x	1.91	x	20.32	x	0.63	x	0.7	=	11.86	(74)
North	0.9x	0.77	x	1.91	x	34.53	x	0.63	x	0.7	=	20.16	(74)
North	0.9x	0.77	x	1.91	x	55.46	x	0.63	x	0.7	=	32.38	(74)
North	0.9x	0.77	x	1.91	x	74.72	x	0.63	x	0.7	=	43.61	(74)
North	0.9x	0.77	x	1.91	x	79.99	x	0.63	x	0.7	=	46.69	(74)
North	0.9x	0.77	x	1.91	x	74.68	x	0.63	x	0.7	=	43.59	(74)
North	0.9x	0.77	x	1.91	x	59.25	x	0.63	x	0.7	=	34.58	(74)
North	0.9x	0.77	x	1.91	x	41.52	x	0.63	x	0.7	=	24.23	(74)
North	0.9x	0.77	x	1.91	x	24.19	x	0.63	x	0.7	=	14.12	(74)
North	0.9x	0.77	x	1.91	x	13.12	x	0.63	x	0.7	=	7.66	(74)
North	0.9x	0.77	x	1.91	x	8.86	x	0.63	x	0.7	=	5.17	(74)
East	0.9x	0.77	x	1.64	x	19.64	x	0.63	x	0.7	=	9.84	(76)
East	0.9x	0.77	x	1.64	x	38.42	x	0.63	x	0.7	=	19.26	(76)
East	0.9x	0.77	x	1.64	x	63.27	x	0.63	x	0.7	=	31.71	(76)
East	0.9x	0.77	x	1.64	x	92.28	x	0.63	x	0.7	=	46.25	(76)
East	0.9x	0.77	x	1.64	x	113.09	x	0.63	x	0.7	=	56.68	(76)
East	0.9x	0.77	x	1.64	x	115.77	x	0.63	x	0.7	=	58.02	(76)
East	0.9x	0.77	x	1.64	x	110.22	x	0.63	x	0.7	=	55.24	(76)
East	0.9x	0.77	x	1.64	x	94.68	x	0.63	x	0.7	=	47.45	(76)
East	0.9x	0.77	x	1.64	x	73.59	x	0.63	x	0.7	=	36.88	(76)
East	0.9x	0.77	x	1.64	x	45.59	x	0.63	x	0.7	=	22.85	(76)
East	0.9x	0.77	x	1.64	x	24.49	x	0.63	x	0.7	=	12.27	(76)
East	0.9x	0.77	x	1.64	x	16.15	x	0.63	x	0.7	=	8.1	(76)
South	0.9x	0.77	x	3.05	x	46.75	x	0.63	x	0.7	=	43.58	(78)
South	0.9x	0.77	x	3.05	x	76.57	x	0.63	x	0.7	=	71.37	(78)
South	0.9x	0.77	x	3.05	x	97.53	x	0.63	x	0.7	=	90.91	(78)
South	0.9x	0.77	x	3.05	x	110.23	x	0.63	x	0.7	=	102.75	(78)
South	0.9x	0.77	x	3.05	x	114.87	x	0.63	x	0.7	=	107.07	(78)
South	0.9x	0.77	x	3.05	x	110.55	x	0.63	x	0.7	=	103.04	(78)
South	0.9x	0.77	x	3.05	x	108.01	x	0.63	x	0.7	=	100.68	(78)
South	0.9x	0.77	x	3.05	x	104.89	x	0.63	x	0.7	=	97.77	(78)
South	0.9x	0.77	x	3.05	x	101.89	x	0.63	x	0.7	=	94.97	(78)
South	0.9x	0.77	x	3.05	x	82.59	x	0.63	x	0.7	=	76.98	(78)
South	0.9x	0.77	x	3.05	x	55.42	x	0.63	x	0.7	=	51.66	(78)
South	0.9x	0.77	x	3.05	x	40.4	x	0.63	x	0.7	=	37.66	(78)
Rooflights	0.9x	1	x	0.65	x	18.19	x	0.63	x	0.7	=	4.69	(82)
Rooflights	0.9x	1	x	0.65	x	38.49	x	0.63	x	0.7	=	9.93	(82)
Rooflights	0.9x	1	x	0.65	x	35.61	x	0.63	x	0.7	=	9.19	(82)

TER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	0.65	x	72.74	x	0.63	x	0.7	=	18.77	(82)
Rooflights 0.9x	1	x	0.65	x	66	x	0.63	x	0.7	=	17.03	(82)
Rooflights 0.9x	1	x	0.65	x	115.41	x	0.63	x	0.7	=	29.77	(82)
Rooflights 0.9x	1	x	0.65	x	118.86	x	0.63	x	0.7	=	30.66	(82)
Rooflights 0.9x	1	x	0.65	x	164.44	x	0.63	x	0.7	=	42.42	(82)
Rooflights 0.9x	1	x	0.65	x	172.87	x	0.63	x	0.7	=	44.6	(82)
Rooflights 0.9x	1	x	0.65	x	200.02	x	0.63	x	0.7	=	51.6	(82)
Rooflights 0.9x	1	x	0.65	x	190.66	x	0.63	x	0.7	=	49.19	(82)
Rooflights 0.9x	1	x	0.65	x	204.54	x	0.63	x	0.7	=	52.77	(82)
Rooflights 0.9x	1	x	0.65	x	175.78	x	0.63	x	0.7	=	45.35	(82)
Rooflights 0.9x	1	x	0.65	x	194.79	x	0.63	x	0.7	=	50.25	(82)
Rooflights 0.9x	1	x	0.65	x	131.53	x	0.63	x	0.7	=	33.93	(82)
Rooflights 0.9x	1	x	0.65	x	167.99	x	0.63	x	0.7	=	43.34	(82)
Rooflights 0.9x	1	x	0.65	x	83.13	x	0.63	x	0.7	=	21.45	(82)
Rooflights 0.9x	1	x	0.65	x	132.7	x	0.63	x	0.7	=	34.23	(82)
Rooflights 0.9x	1	x	0.65	x	43.53	x	0.63	x	0.7	=	11.23	(82)
Rooflights 0.9x	1	x	0.65	x	84.98	x	0.63	x	0.7	=	21.92	(82)
Rooflights 0.9x	1	x	0.65	x	22.51	x	0.63	x	0.7	=	5.81	(82)
Rooflights 0.9x	1	x	0.65	x	47.49	x	0.63	x	0.7	=	12.25	(82)
Rooflights 0.9x	1	x	0.65	x	15.16	x	0.63	x	0.7	=	3.91	(82)
Rooflights 0.9x	1	x	0.65	x	32	x	0.63	x	0.7	=	8.26	(82)

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

(83)m=	74.25	130.44	189.58	254.47	303.57	309.71	295.11	257.08	211.77	147.1	89.64	63.09	(83)

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

(84)m=	354.06	408.73	459.61	511.35	547.49	540.83	517.71	484.03	445.29	393.92	351.73	336.26	(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	0.96	0.9	0.77	0.59	0.43	0.48	0.72	0.92	0.98	0.99	(86)

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

(87)m=	19.77	19.96	20.25	20.6	20.85	20.97	20.99	20.99	20.92	20.59	20.12	19.74	(87)

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

(88)m=	19.81	19.82	19.82	19.84	19.84	19.85	19.85	19.86	19.85	19.84	19.83	19.83	(88)

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

(89)m=	0.99	0.98	0.95	0.86	0.71	0.49	0.32	0.37	0.63	0.89	0.97	0.99	(89)

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

(90)m=	18.21	18.49	18.9	19.39	19.71	19.83	19.85	19.85	19.79	19.4	18.74	18.18	(90)

fLA = Living area ÷ (4) = 0.52 (91)

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

TER WorkSheet: New dwelling design stage

(92)m=	19.02	19.26	19.6	20.02	20.3	20.43	20.45	20.45	20.38	20.02	19.46	18.99	(92)

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

(93)m=	19.02	19.26	19.6	20.02	20.3	20.43	20.45	20.45	20.38	20.02	19.46	18.99	(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=	0.98	0.97	0.94	0.87	0.73	0.54	0.38	0.43	0.68	0.9	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	348.61	397.07	433.06	444.79	401.01	291.65	197.26	206.02	300.72	354.08	341.51	332.02	(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=	791.33	769.04	699.6	584.46	450.71	300.96	198.76	208.47	326.07	493.56	651.57	784.69	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	329.39	249.96	198.31	100.57	36.98	0	0	0	0	103.77	223.25	336.78	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1579 (98)

Space heating requirement in kWh/m²/year 39.23 (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 93.5 (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)													
	329.39	249.96	198.31	100.57	36.98	0	0	0	0	103.77	223.25	336.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	352.29	267.34	212.09	107.56	39.55	0	0	0	0	110.99	238.77	360.19	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1688.77 (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)

	157.13	138.76	146.35	132.06	130.05	117.1	113.32	123.17	122.58	136.9	143.67	153.64	

Efficiency of water heater 79.8 (216)

(217)m=	86.74	86.37	85.62	84.1	81.94	79.8	79.8	79.8	79.8	84.09	85.99	86.85	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.14	160.66	170.92	157.03	158.7	146.75	142.01	154.35	153.61	162.81	167.08	176.9	

Total = Sum(219a)$_{1...12}$ = 1931.95 (219)

TER WorkSheet: New dwelling design stage

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1688.77	
Water heating fuel used		1931.95	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		193.41	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3889.14	(338)

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	0.216	=	364.78	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	417.3	(264)
Space and water heating	(261) + (262) + (263) + (264) =				782.08	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	100.38	(268)
Total CO2, kg/year	sum of (265)…(271) =				921.38	(272)

TER = 33.58 (273)