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c/c David Seaman
John Reeves
Sally Reeves

Therm Energy Limited
1 Tarrant Street
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BN18 9DG

Our Reference : YI-47

Sent By : E-Mail

16 June 2021

Dear Matt

Re : 107 Felpham Way, Felpham PO22 8QB - Planning Condition (Renewables/LZCs)

Further to completion of the revised design stage thermal (SAP) calculations (copies attached), we are pleased to confirm the following :

Base Energy (Total) = 12,934.51 kWh/year

Energy From LZCs = 3,268.28 kWh/year

LZC (Solar PV) = 4.5 kW/peak total

Energy From LZCs = 25.27%

Energy from renewables or low carbon energy sources (on-site) > 10% as required, therefore the proposal meets the requirements of Policy ECC SP2 of the Arun Local Plan.

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

Yours sincerely

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

Construction and Insulation

<u>Element</u>	<u>U-Value</u> (W/m ² K)
<u>Exposed Wall</u> (brick) 102.5mm facing brick outer leaf + 100mm cavity with 90mm Kingspan Kooltherm K106 insulation + 100mm Hemelite medium dense concrete 7.3N block inner leaf + 12.5mm plasterboard on dabs internal finish.	0.17
<u>Exposed Wall</u> (render) Render + 100mm medium dense block outer leaf + 100mm cavity with 90mm Kingspan Kooltherm K106 insulation + 100mm Hemelite medium dense concrete 7.3N block inner leaf + 12.5mm plasterboard on dabs internal finish.	0.17
<u>Exposed Wall</u> (unit 1-commercial) As party wall Option 1 or 2.	0.25
<u>Exposed Wall</u> (flat-common) As party wall Option 1 or 2.	0.34
<u>Party Wall</u> (option 1) 75mm metal c-studs (2 rows) with 75mm acoustic mineral wool insulation between both sets of studs) + minimum 5mm clear gap between studs + 12.5mm plasterboard + plaster skim both sides.	0.20
<u>Party Wall</u> (option 2) 146mm Gyframe AS 50 AcouStud (150mm Isover APR 1200 insulation between) + 2 layers of 15mm acoustic plasterboard + plaster skim both sides.	0.00
Note 1 : Effective edge sealing at all exposed edges, and in line with insulation layers in abutting elements.	
Note 2 : Therm Energy Can Provide Sound Testing.	
<u>Internal Partitions</u> Metal studs + plasterboard.	NA
<u>Ground Floor</u> 18mm chipboard + 125mm Kingspan Thermafloor TF70 insulation + 150mm solid concrete floor.	0.14
<u>First Floor</u> (exposed bay) 24mm plywood + 150mm timber joists (140mm Ecotherm insulation between) + 50mm Knauf Rocksilk soffit liner board + 12mm plywood + soffit board.	0.15
<u>First Floor</u> (over commercial) 18mm plywood + 15mm plasterboard + 70mm resilient battens (70mm acoustic mineral wool insulation between) + 18mm plywood + engineered timber joists (150mm acoustic mineral wool insulation between) + resilient bars + 15mm plasterboard (2 layers).	0.09
<u>Roof</u> (pitched) 35mm Actis Boost R Hybrid multi-foil (over rafters) + 125mm Actis Hybris insulation (between rafters) + 45mm Actis H Control Hybrid multi-foil (under rafters) + battens + plasterboard.	0.13
<u>Roof</u> (flat) Insulated to achieve a U-value of 0.18W/m ² K (or better).	0.18
<u>Roof</u> (flat - dormers)	

120mm Kingspan Thermaroom TR27 insulation (over timber roof deck).	0.18
<u>Windows/Doors</u> PVC-u frame double-glazed + 16mm cavity (argon gas fill) + soft coat low-E glass + warm edge spacer.	1.40
<u>Rooflights</u> PVC-u frame double-glazed + 16mm cavity (argon gas fill) + soft coat low-E glass + warm edge spacer.	1.30
Note : U-value certification will be required from the supplier for the windows, doors & rooflights upon completion.	

<u>Heating, Ventilation & Renewables</u>	
<u>Main Heating System</u> Electric panels heaters with programmers + appliance thermostats (standard tariff electric).	
<u>Secondary Heating System</u> Not applicable.	
<u>Water Heating</u> Electric immersion in hot water cylinder (factory PIR insulation, heat loss TBC kWh/day) + thermostat.	
<u>Ventilation</u> Background ventilators + intermittent extract fans (Approved Document F1, 2010, amended 2013).	
<u>Renewables</u> (unit 3) Solar PV panels, 4.5 kW/peak (eg 14 x 320W panels = approx 24m²), on west/south-west facing roof slope (very little over-shading).	

<u>Other</u>	
<u>Orientation/Shading</u> The building front faces approx south. Sides sheltered = 3 no.	
<u>Detailing</u> (ACDs) Accredited construction details (limiting thermal bridging and air leakage) fully adopted : see www.planningportal.gov.uk . Lintels are IG Hi-Therm (or equal).	
<u>Lighting</u> 100% of internal light fittings are low-energy (lamp luminous efficacy > 45 lumens/circuit watt, total output > 400 lamp lumens).	
<u>Water Use</u> Total water use < 125 litres/person/day.	
<u>Air Tightness</u> Design air permeability is 6m³/h/m² at 50 Pa - to be achieved by air pressure test. Note : Therm Energy Can Provide Air Leakage Testing.	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 16 June 2021 at 14:43:19

Project Information:

Assessed By: Joe Solti (STRO003946)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 61.05m²

Site Reference : YI-47

Plot Reference: YI4701A

Address : Unit 1, 107 Felpham Way, Felpham, PO22 8QB

Client Details:

Name: Pickup Town Planning

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)

30.3 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

39.21 kg/m²

Fail

Excess emissions = 8.91 kg/m² (29.4 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

57.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

49.6 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.21 (max. 0.30)

0.34 (max. 0.70)

OK

Floor

0.14 (max. 0.25)

0.14 (max. 0.70)

OK

Roof

(no roof)

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

6.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Room heaters - electric
Panel, convector or radiant heaters

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.80 kWh/day
Permitted by DBSCG: 2.10 kWh/day

OK

Primary pipework insulated:

No primary pipework

Regulations Compliance Report

6 Controls

Space heating controls	Programmer and appliance thermostats	OK
Hot water controls:	Cylinderstat	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):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: North	1.3m ²
Windows facing: North	1.3m ²
Ventilation rate:	2.00
Blinds/curtains:	None

10 Key features

Thermal bridging	0.024 W/m ² K
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SAP Input

Property Details: Y04701A

Address: Unit 1, 107 Felpham Way, Felpham, PO22 8QB
Located in: England
Region: South East England
UPRN:
Date of assessment: 16 June 2021
Date of certificate: 16 June 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Calculated 177.88
Water use <= 125 litres/ person/ day: True
PCDF Version: 478

Property description

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 61.05 m² 2.373 m
Living area: 25.7 m² (fraction 0.421)
Front of dwelling faces: East

Opening types

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

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	16mm or more mm	0.7	0.63	1.4	2.1	1
Patio Doors	16mm or more mm	0.7	0.63	1.4	5.3	1
Windows (N)	16mm or more	0.7	0.63	1.4	1.3	1
Windows (E)	16mm or more	0.7	0.63	1.4	1.3	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall (external)	East	0	0
Patio Doors		Wall (external)	North	0	0
Windows (N)		Wall (external)	North	0	0
Windows (E)		Wall (external)	North	0	0

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
Wall (external)	57.7	10	47.7	0.17	0	False	150
Wall (commercial)	3.8	0	3.8	0.25	0	False	14
Wall (common)	13.1	0	13.1	0.5	0.9	False	14
Ground Floor	61.05			0.14			20
Internal Elements							
Walls	114						9
Party Elements							

SAP Input

Ceiling

61.05

20

Thermal bridges:

Thermal bridges:	User-defined (individual PSI-values) Y-Value = 0.0243			
	Length	Psi-value		
	5.9	0.022	E2	Other lintels (including other steel lintels)
	2.4	0.032	E3	Sill
	12.6	0.018	E4	Jamb
	31.4	0.064	E5	Ground floor (normal)
[Approved]	0	0.06	E10	Eaves (insulation at ceiling level)
[Approved]	0	0.04	E11	Eaves (insulation at rafter level)
[Approved]	0	0.24	E12	Gable (insulation at ceiling level)
[Approved]	0	0.04	E13	Gable (insulation at rafter level)
[Approved]	9.5	0.09	E16	Corner (normal)
[Approved]	0	0.06	E18	Party wall between dwellings
	0	0.32	E20	Exposed floor (normal)

Ventilation

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	2
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	6

Main heating system:

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

Main heating Control:

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

Secondary heating system:

Secondary heating system:	None
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Water heating:

Water heating:	Electric immersion (on-peak or off-peak)
	Water code: 903
	Fuel :Electricity
	Hot water cylinder
	Cylinder volume: 180 litres
	Cylinder insulation: Measured loss, 1.8kWh/day
	Primary pipework insulation: False
	Cylinderstat: True
	Cylinder in heated space: True
	Immersion: Single
	Solar panel: False

SAP Input

Client

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: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: 44/01A

Address : Unit 1, 107 Felpham Way, Felpham, PO22 8QB

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	61.05 (1a)	2.37 (2a)	144.87 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	61.05 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	144.87 (5)

2. Ventilation rate

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			6 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.44 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.34 (21)

Infiltration rate modified for monthly wind speed

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

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

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

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

0.43	0.42	0.42	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.59 0.59 0.59 0.57 0.57 0.55 0.55 0.55 0.56 0.57 0.57 0.58 (24d)

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

(25)m= 0.59 0.59 0.59 0.57 0.57 0.55 0.55 0.55 0.56 0.57 0.57 0.58 (25)

3. Heat losses and heat capacity parameter

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors Type 1			2.1	1.4	2.94		(26)
Doors Type 2			5.3	1.4	7.42		(26)
Windows Type 1			1.3	$\times 1/[1/(1.4) + 0.04]$	1.72		(27)
Windows Type 2			1.3	$\times 1/[1/(1.4) + 0.04]$	1.72		(27)
Floor			61.05	0.14	8.547	20	1221 (28)
Walls Type1	57.7	10	47.7	0.17	8.11	150	7155 (29)
Walls Type2	3.8	0	3.8	0.25	0.95	14	53.2 (29)
Walls Type3	13.1	0	13.1	0.34	4.52	14	183.4 (29)
Total area of elements, m²			135.65				(31)
Party ceiling			61.05			20	1221 (32b)
Internal wall **			114			9	1026 (32c)

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

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

Fabric heat loss, W/K = S (A x U) (26) ... (30) + (32) = 35.93 (33)

Heat capacity Cm = S(A x k) ((28) ... (30) + (32) + (32a) ... (32e) = 10859.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 177.88 (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 3.3 (36)

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

Total fabric heat loss (33) + (36) = 39.23 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$\{38\}m = 0.33 \times \{25\}m \times \{5\}$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
{38}m=	28.38	28.21	28.04	27.24	27.09	26.39	26.39	26.26	26.66	27.09	27.39	27.71	{38}

Heat transfer coefficient, W/K

$$\{39\}m = \{37\} + \{38\}m$$

{39}m=	67.61	67.44	67.27	66.47	66.32	65.62	65.62	65.49	65.89	66.32	66.62	66.94	
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Heat loss parameter (HLP), W/m²K

$$\text{Average} = \text{Sum}\{39\}_{1..12} / 12 =$$

66.46 {39}

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

{40}m=	1.11	1.1	1.1	1.09	1.09	1.07	1.07	1.07	1.08	1.09	1.09	1.1	
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$$\text{Average} = \text{Sum}\{40\}_{1..12} / 12 =$$

1.09 {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

2.01 {42}

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

if TFA ≤ 13.9, N = 1

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

81.97 {43}

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
{44}m=	90.16	86.88	83.6	80.33	77.05	73.77	73.77	77.05	80.33	83.6	86.88	90.16	
Total = Sum{44}_{1..12} =												983.58	{44}

Hot water usage in litres per day for each month $Vd_m = \text{factor from Table 1c} \times \{43\}$

Energy content of hot water used - calculated monthly = $4.190 \times Vd_m \times nm \times DTm / 3600$ kWh/month (see Tables 1b, 1c, 1d)

{45}m=	133.71	116.94	120.67	105.21	100.95	87.11	80.72	92.63	93.73	109.24	119.24	129.49	
Total = Sum{45}_{1..12} =												1289.63	{45}

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

{46}m=	20.06	17.54	18.1	15.78	15.14	13.07	12.11	13.89	14.06	16.39	17.89	19.42	{46}
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Water storage loss:

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

180 {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):

1.8 {48}

Temperature factor from Table 2b

0.6 {49}

Energy lost from water storage, kWh/year

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

1.08 {50}

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

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

0 {51}

If community heating see section 4.3

Volume factor from Table 2a

0 {52}

Temperature factor from Table 2b

0 {53}

Energy lost from water storage, kWh/year

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

0 {54}

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

1.08 {55}

Water storage loss calculated for each month

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

{56}m=	33.48	30.24	33.48	32.4	33.48	32.4	33.48	33.48	32.4	33.48	32.4	33.48	{56}
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SAP WorkSheet: New dwelling design stage

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

(57)m=	33.48	30.24	33.48	32.4	33.48	32.4	33.48	33.48	32.4	33.48	32.4	33.48	(57)
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Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

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

(62)m=	167.19	147.18	154.15	137.61	134.43	119.51	114.2	126.11	126.13	142.72	151.64	162.97	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

Output from water heater

(64)m=	167.19	147.18	154.15	137.61	134.43	119.51	114.2	126.11	126.13	142.72	151.64	162.97	
Output from water heater (annual) $\times 12$												1683.83	(64)

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

(65)m=	71.24	63.07	66.91	60.9	60.35	54.88	53.62	57.58	57.09	63.11	65.57	69.84	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.67	120.67	120.67	120.67	120.67	120.67	120.67	120.67	120.67	120.67	120.67	120.67	(66)

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

(67)m=	40.64	36.1	29.36	22.22	16.61	14.03	15.16	19.7	26.44	33.57	39.18	41.77	(67)
--------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(68)m=	262.07	264.79	257.94	243.35	224.93	207.62	196.06	193.34	200.19	214.78	233.2	250.51	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

(69)m=	49.08	49.08	49.08	49.08	49.08	49.08	49.08	49.08	49.08	49.08	49.08	49.08	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

(71)m=	-80.45	-80.45	-80.45	-80.45	-80.45	-80.45	-80.45	-80.45	-80.45	-80.45	-80.45	-80.45	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	95.75	93.86	89.93	84.58	81.11	76.23	72.07	77.4	79.29	84.82	91.07	93.87	(72)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(73)m=	487.77	484.05	466.52	439.46	411.96	387.18	372.59	379.74	395.22	422.48	452.75	475.45	(73)
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6. Solar gains

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
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SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.3	x	10.63	x	0.63	x	0.7	=	4.22	(74)
North	0.9x	0.77	x	1.3	x	10.63	x	0.63	x	0.7	=	4.22	(74)
North	0.9x	0.77	x	1.3	x	20.32	x	0.63	x	0.7	=	8.07	(74)
North	0.9x	0.77	x	1.3	x	20.32	x	0.63	x	0.7	=	8.07	(74)
North	0.9x	0.77	x	1.3	x	34.53	x	0.63	x	0.7	=	13.72	(74)
North	0.9x	0.77	x	1.3	x	34.53	x	0.63	x	0.7	=	13.72	(74)
North	0.9x	0.77	x	1.3	x	55.46	x	0.63	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	1.3	x	55.46	x	0.63	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	1.3	x	74.72	x	0.63	x	0.7	=	29.68	(74)
North	0.9x	0.77	x	1.3	x	74.72	x	0.63	x	0.7	=	29.68	(74)
North	0.9x	0.77	x	1.3	x	79.99	x	0.63	x	0.7	=	31.78	(74)
North	0.9x	0.77	x	1.3	x	79.99	x	0.63	x	0.7	=	31.78	(74)
North	0.9x	0.77	x	1.3	x	74.68	x	0.63	x	0.7	=	29.67	(74)
North	0.9x	0.77	x	1.3	x	74.68	x	0.63	x	0.7	=	29.67	(74)
North	0.9x	0.77	x	1.3	x	59.25	x	0.63	x	0.7	=	23.54	(74)
North	0.9x	0.77	x	1.3	x	59.25	x	0.63	x	0.7	=	23.54	(74)
North	0.9x	0.77	x	1.3	x	41.52	x	0.63	x	0.7	=	16.49	(74)
North	0.9x	0.77	x	1.3	x	41.52	x	0.63	x	0.7	=	16.49	(74)
North	0.9x	0.77	x	1.3	x	24.19	x	0.63	x	0.7	=	9.61	(74)
North	0.9x	0.77	x	1.3	x	24.19	x	0.63	x	0.7	=	9.61	(74)
North	0.9x	0.77	x	1.3	x	13.12	x	0.63	x	0.7	=	5.21	(74)
North	0.9x	0.77	x	1.3	x	13.12	x	0.63	x	0.7	=	5.21	(74)
North	0.9x	0.77	x	1.3	x	8.86	x	0.63	x	0.7	=	3.52	(74)
North	0.9x	0.77	x	1.3	x	8.86	x	0.63	x	0.7	=	3.52	(74)

Solar gains in watts, calculated for each month

$$(63)_m = \text{Sum}(74)_m \dots (82)_m$$

(83)m=	8.45	16.15	27.44	44.07	59.37	63.56	59.34	47.08	32.99	19.22	10.42	7.04	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	496.22	500.2	493.96	483.53	471.33	450.73	431.93	426.81	428.21	441.7	463.17	482.49	(84)
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7. Mean internal temperature (breeding season)

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

21 (85)

Utilisation factor for gains for living area, $h_{1,m}$ (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.97	0.97	0.94	0.89	0.77	0.62	0.65	0.83	0.93	0.97	0.98	(86)

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

(87)m=	19.7	19.8	20	20.3	20.6	20.86	20.96	20.95	20.79	20.44	20.03	19.69	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	20	20	20.01	20.01	20.02	20.02	20.02	20.02	20.01	20.01	20	(88)
--------	-------	----	----	-------	-------	-------	-------	-------	-------	-------	-------	----	------

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

(89)m=	0.97	0.97	0.96	0.93	0.86	0.7	0.5	0.53	0.76	0.91	0.96	0.98	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

SAP WorkSheet: New dwelling design stage

(90)m=	18.29	18.42	18.72	19.15	19.58	19.9	20	19.99	19.83	19.36	18.78	18.27	(90)
fLA = Living area ÷ (4) =													(91)
												0.42	

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

(92)m=	18.89	19	19.25	19.63	20.01	20.3	20.4	20.39	20.24	19.81	19.31	18.87	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.89	19	19.25	19.63	20.01	20.3	20.4	20.39	20.24	19.81	19.31	18.87	(93)
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4. Space heating requirement

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

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

(94)m=	0.97	0.96	0.95	0.92	0.86	0.72	0.55	0.58	0.78	0.91	0.95	0.97	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	479.59	481.06	469.23	445.62	404.65	325.31	237.39	246.55	333.31	400.57	441.11	467.8	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm, W = [(39)m x [(93)m – (96)m]

(97)m=	986.14	950.92	857.94	713.48	551.05	374.14	249.46	261.61	404.3	610.9	813.25	981.62	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	376.87	315.75	289.2	192.86	108.93	0	0	0	0	156.48	267.94	382.28	
Total per year (kWh/year) = Sum(98) _{1,5,6,12} =													(98)
												2090.31	

Space heating requirement in kWh/m²/year

34.24 (99)

5. 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 1 100 (206)

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

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

Space heating requirement (calculated above)

376.87	315.75	289.2	192.86	108.93	0	0	0	0	156.48	267.94	382.28
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(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

376.87	315.75	289.2	192.86	108.93	0	0	0	0	156.48	267.94	382.28
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Total (kWh/year) = Sum(211)_{1,5,6,12} = 2090.31 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) = Sum(215) _{1,5,6,12} =													(215)
												0	

Water heating

Output from water heater (calculated above)

167.19	147.18	154.15	137.61	134.43	119.51	114.2	126.11	126.13	142.72	151.64	162.97
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Efficiency of water heater 100 (216)

SAP WorkSheet: New dwelling design stage

{217)m=	100	100	100	100	100	100	100	100	100	100	100	{217}
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

{219)m=	167.19	147.18	154.15	137.61	134.43	119.51	114.2	126.11	126.13	142.72	151.64	162.97	
Total = Sum{219a}...{219j} =												1683.83	{219}

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2090.31
Water heating fuel used		1683.83
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0
Electricity for lighting		287.1
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4061.25

11a Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	{211} x	13.19	275.71
Space heating - main system 2	{213} x	0	0
Space heating - secondary	{215} x	13.19	0
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	
Low-rate fraction	1.0 - (243) =	0	
High-rate cost	{219} x (243) x	13.19	222.1
Low-rate cost	{219} x (244) x	13.19	0
Pumps, fans and electric keep-hot	{231}	13.19	0
(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	37.87
Additional standing charges (Table 12)			0
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		535.68

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	2.12
SAP rating (Section 12)		70.41

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	1084.87
Space heating (secondary)	{215} x	0.519	0

SAP WorkSheet: New dwelling design stage

Water heating	{219} x	0.519	=	873.91	{264}
Space and water heating	{261} + {262} + {263} + {264} =			1958.78	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	0.519	=	0	{267}
Electricity for lighting	{232} x	0.519	=	149.01	{268}
Total CO2, kg/year		sum of {265}...{271} =		2107.79	{272}
CO2 emissions per m²		{272} ÷ {4} =		34.53	{273}
El rating (section 14)				73	{274}

12a Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	{211} x	3.07	=	6417.27	{261}
Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	5169.36	{264}
Space and water heating	{261} + {262} + {263} + {264} =			11586.62	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	0	{267}
Electricity for lighting	{232} x	0	=	881.4	{268}
'Total Primary Energy		sum of {265}...{271} =		12468.02	{272}
Primary energy kWh/m²/year		{272} ÷ {4} =		204.23	{273}

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 16 June 2021 at 14:43:18

Project Information:

Assessed By: Joe Solti (STRO003946)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 74m²

Site Reference : YI-47

Plot Reference: YI4702A

Address : Unit 2, 107 Felpham Way, Felpham, PO22 8QB

Client Details:

Name: Pickup Town Planning

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)

29.89 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

37.83 kg/m²

Fail

Excess emissions = 7.94 kg/m² (26.6 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

61.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

51.8 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.21 (max. 0.30)

0.34 (max. 0.70)

OK

Party wall

0.20 (max. 0.20)

-

OK

Floor

0.09 (max. 0.25)

0.09 (max. 0.70)

OK

Roof

0.13 (max. 0.20)

0.13 (max. 0.35)

OK

Openings

1.38 (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

6.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Room heaters - electric

Panel, convector or radiant heaters

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.80 kWh/day

Permitted by DBSCG: 2.10 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

Space heating controls	Programmer and appliance thermostats	OK
Hot water controls:	Cylinderstat	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
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Based on:

Overshading:	Average or unknown
Windows facing: South	5.7m ²
Windows facing: East	2.6m ²
Windows facing: West	1.9m ²
Roof windows facing: East	0.86m ²
Roof windows facing: West	1.47m ²
Ventilation rate:	3.00
Blinds/curtains:	None

10 Key features

Floors U-value	0.09 W/m ² K
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SAP Input

Property Details: Y04702A

Address: Unit 2, 107 Felpham Way, Felpham, PO22 8QB
Located in: England
Region: South East England
UPRN:
Date of assessment: 16 June 2021
Date of certificate: 16 June 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Calculated 151.36
Water use <= 125 litres/ person/ day: True
PCDF Version: 478

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 74 m² 2.373 m
Living area: 33.7 m² (fraction 0.455)
Front of dwelling faces: North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Solid	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (S)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (E)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (W)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Rooflights (E)	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood
Rooflights (W)	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	16mm or more mm	0.7	0.63	1.4	1.9	1
Windows (S)	16mm or more	0.7	0.63	1.4	5.7	1
Windows (E)	16mm or more	0.7	0.63	1.4	2.6	1
Windows (W)	16mm or more	0.7	0.63	1.4	1.9	1
Rooflights (E)	16mm or more	0.7	0.63	1.3	0.86	1
Rooflights (W)	16mm or more	0.7	0.63	1.3	1.47	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall (common)	North	0	0
Windows (S)		Wall (external)	South	0	0
Windows (E)		Wall (external)	East	0	0
Windows (W)		Wall (external)	West	0	0
Rooflights (E)		Roof	East	0	0
Rooflights (W)		Roof	West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
Wall (external)	61.3	10.2	51.1	0.17	0	False	150
Wall (common)	15.5	1.9	13.6	0.5	0.9	False	14

SAP Input

Roof	76.1	2.33	73.77	0.13	0	9
Exposed Floor	74			0.09		20
<u>Internal Elements</u>						
Walls	125					9
<u>Party Elements</u>						
Party Wall	3.8					20

Thermal bridges

Thermal bridges:	User-defined (individual PSI-values) Y-Value = 0.0647				
	Length	Psi-value			
	9.3	0.022	E2	Other lintels (including other steel lintels)	
	8.4	0.032	E3	Sill	
	18.4	0.018	E4	Jamb	
	0	0.064	E5	Ground floor (normal)	
[Approved]	0	0.06	E10	Eaves (insulation at ceiling level)	
[Approved]	21.1	0.04	E11	Eaves (insulation at rafter level)	
[Approved]	0	0.24	E12	Gable (insulation at ceiling level)	
[Approved]	8.9	0.04	E13	Gable (insulation at rafter level)	
[Approved]	10.1	0.09	E16	Corner (normal)	
[Approved]	2.3	0.06	E18	Party wall between dwellings	
	35.9	0.32	E20	Exposed floor (normal)	
	1.7	0.08	P5	Roof (insulation at rafter level)	

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	2
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	6

Main heating system:

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

Main heating Control:

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

Secondary heating system:

Secondary heating system:	None
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Water heating

Water heating:	Electric immersion (on-peak or off-peak)
	Water code: 903
	Fuel :Electricity
	Hot water cylinder
	Cylinder volume: 180 litres

SAP Input

Cylinder insulation: Measured loss, 1.8kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Single
Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	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: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: 414/02A

Address : Unit 2, 107 Felpham Way, Felpham, PO22 8QB

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	74 (1a)	2.37 (2a)	175.6 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	175.6 (5)

2. Ventilation rate

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.11 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			6 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.41 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

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

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

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.3	0.32	0.34	0.36	0.38
------	-----	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.57 0.57 (24d)

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

(25)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.57 0.57 (25)

3. Heat losses and heat capacity parameter

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.9	1.4	2.66		(26)
Windows Type 1			5.7	$\times 1/[1/(1.4) + 0.04]$	7.56		(27)
Windows Type 2			2.6	$\times 1/[1/(1.4) + 0.04]$	3.45		(27)
Windows Type 3			1.9	$\times 1/[1/(1.4) + 0.04]$	2.52		(27)
Rooflights Type 1			0.86	$\times 1/[1/(1.3) + 0.04]$	1.118		(27b)
Rooflights Type 2			1.47	$\times 1/[1/(1.3) + 0.04]$	1.911		(27b)
Floor			74	0.09	6.66	20	1480 (28)
Walls Type1	61.3	10.2	51.1	0.17	8.69	150	7665 (29)
Walls Type2	15.5	1.9	13.6	0.34	4.69	14	190.4 (29)
Roof	76.1	2.33	73.77	0.13	9.59	9	663.93 (30)
Total area of elements, m²			226.9				(31)
Party wall			3.8	0.2	0.76	20	76 (32)
Internal wall **			125			9	1125 (32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 49.45 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 11200.33 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 151.36 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 14.68 (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) =

64.12

(37)

Ventilation heat loss calculated monthly

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	33.82	33.63	33.45	32.58	32.42	31.66	31.66	31.53	31.96	32.42	32.75	33.09

(38)

Heat transfer coefficient, W/K

(39)m = (37) ÷ (38)m

(39)m=	97.95	97.76	97.57	96.71	96.54	95.79	95.79	95.65	96.08	96.54	96.87	97.21
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

96.71

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

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

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

1.31

(40)

Number of days in month (Table 1a)

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

(41)

4. Water heating energy requirement

kWh/year

Assumed occupancy, N

2.34

(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

89.76

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of

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

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

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

(44)m=	98.73	95.14	91.55	87.96	84.37	80.78	80.78	84.37	87.96	91.55	95.14	98.73
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

1077.07

(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=	146.42	128.06	132.14	115.21	110.54	95.39	88.39	101.43	102.64	119.62	130.57	141.8
--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	-------

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

1412.21

(45)

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

(46)m=	21.96	19.21	19.82	17.28	16.58	14.31	13.26	15.21	15.4	17.94	19.59	21.27
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

(46)

Water storage loss:

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

180

(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):

1.8

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

1.08

(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)

1.08

(55)

SAP WorkSheet: New dwelling design stage

Water storage loss calculated for each month

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

{56}m=	33.48	30.24	33.48	32.4	33.48	32.4	33.48	33.48	32.4	33.48	32.4	33.48	{56}
--------	-------	-------	-------	------	-------	------	-------	-------	------	-------	------	-------	------

If cylinder contains dedicated solar storage, $\{(57)\}m = \{(56)\}m \times [(\{(50)\}) - (H11)] \div \{(50)\}$, else $\{(57)\}m = \{(56)\}m$ where (H11) is from Appendix H

{57}m=	33.48	30.24	33.48	32.4	33.48	32.4	33.48	33.48	32.4	33.48	32.4	33.48	{57}
--------	-------	-------	-------	------	-------	------	-------	-------	------	-------	------	-------	------

Primary circuit loss (annual) from Table 3

0

{58}

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

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

{59}m=	0	0	0	0	0	0	0	0	0	0	0	0	{59}
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Combi loss calculated for each month $\{(61)\}m = \{(60)\} \div 365 \times \{(41)\}m$

{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 $\{(62)\}m = 0.85 \times \{(45)\}m + \{(46)\}m + \{(57)\}m + \{(59)\}m + \{(61)\}m$

{62}m=	179.9	158.3	165.62	147.61	144.02	127.79	121.87	134.91	135.04	153.1	162.97	175.28	{62}
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

Output from water heater

{64}m=	179.9	158.3	165.62	147.61	144.02	127.79	121.87	134.91	135.04	153.1	162.97	175.28	
Output from water heater (annual) $\{(64)\}$												1806.41	{64}

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

{65}m=	75.47	66.77	70.72	64.23	63.54	57.64	56.17	60.51	60.05	66.56	69.34	73.93	{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=	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35	{66}

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

{67}m=	47.18	41.9	34.08	25.8	19.29	16.28	17.59	22.87	30.69	38.97	45.49	48.49	{67}
--------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

{68}m=	308.13	311.33	303.27	286.12	264.46	244.11	230.52	227.32	235.38	252.53	274.18	294.53	{68}
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

{69}m=	51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37	{69}
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

{70}m=	0	0	0	0	0	0	0	0	0	0	0	0	{70}
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

{71}m=	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	{71}
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

{72}m=	101.43	99.36	95.06	89.2	85.4	80.05	75.5	81.33	83.4	89.46	96.3	99.37	{72}
--------	--------	-------	-------	------	------	-------	------	-------	------	-------	------	-------	------

Total internal gains =

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

{73}m=	554.9	550.75	530.56	499.28	467.31	438.6	421.77	429.68	447.63	479.12	514.13	540.55	{73}
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6 Solar gains

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

SAP WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	2.6	x	19.64	x	0.63	x	0.7	=	15.61 (76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.63	x	0.7	=	30.53 (76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.63	x	0.7	=	50.28 (76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.63	x	0.7	=	73.33 (76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.63	x	0.7	=	89.86 (76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.63	x	0.7	=	91.99 (76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.63	x	0.7	=	87.58 (76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.63	x	0.7	=	75.23 (76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.63	x	0.7	=	58.47 (76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.63	x	0.7	=	36.22 (76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.63	x	0.7	=	19.46 (76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.63	x	0.7	=	12.83 (76)
South	0.9x	0.77	x	5.7	x	46.75	x	0.63	x	0.7	=	81.44 (78)
South	0.9x	0.77	x	5.7	x	76.57	x	0.63	x	0.7	=	133.38 (78)
South	0.9x	0.77	x	5.7	x	97.53	x	0.63	x	0.7	=	169.9 (78)
South	0.9x	0.77	x	5.7	x	110.23	x	0.63	x	0.7	=	192.03 (78)
South	0.9x	0.77	x	5.7	x	114.87	x	0.63	x	0.7	=	200.1 (78)
South	0.9x	0.77	x	5.7	x	110.55	x	0.63	x	0.7	=	192.57 (78)
South	0.9x	0.77	x	5.7	x	108.01	x	0.63	x	0.7	=	188.16 (78)
South	0.9x	0.77	x	5.7	x	104.89	x	0.63	x	0.7	=	182.73 (78)
South	0.9x	0.77	x	5.7	x	101.89	x	0.63	x	0.7	=	177.48 (78)
South	0.9x	0.77	x	5.7	x	82.59	x	0.63	x	0.7	=	143.86 (78)
South	0.9x	0.77	x	5.7	x	55.42	x	0.63	x	0.7	=	96.54 (78)
South	0.9x	0.77	x	5.7	x	40.4	x	0.63	x	0.7	=	70.37 (78)
West	0.9x	0.77	x	1.9	x	19.64	x	0.63	x	0.7	=	11.4 (80)
West	0.9x	0.77	x	1.9	x	38.42	x	0.63	x	0.7	=	22.31 (80)
West	0.9x	0.77	x	1.9	x	63.27	x	0.63	x	0.7	=	36.74 (80)
West	0.9x	0.77	x	1.9	x	92.28	x	0.63	x	0.7	=	53.58 (80)
West	0.9x	0.77	x	1.9	x	113.09	x	0.63	x	0.7	=	65.67 (80)
West	0.9x	0.77	x	1.9	x	115.77	x	0.63	x	0.7	=	67.22 (80)
West	0.9x	0.77	x	1.9	x	110.22	x	0.63	x	0.7	=	64 (80)
West	0.9x	0.77	x	1.9	x	94.68	x	0.63	x	0.7	=	54.97 (80)
West	0.9x	0.77	x	1.9	x	73.59	x	0.63	x	0.7	=	42.73 (80)
West	0.9x	0.77	x	1.9	x	45.59	x	0.63	x	0.7	=	26.47 (80)
West	0.9x	0.77	x	1.9	x	24.49	x	0.63	x	0.7	=	14.22 (80)
West	0.9x	0.77	x	1.9	x	16.15	x	0.63	x	0.7	=	9.38 (80)
Rooflights	0.9x	1	x	0.86	x	26.56	x	0.63	x	0.7	=	9.07 (82)
Rooflights	0.9x	1	x	1.47	x	26.56	x	0.63	x	0.7	=	15.5 (82)
Rooflights	0.9x	1	x	0.86	x	53.61	x	0.63	x	0.7	=	18.3 (82)

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Rooflights 0.9x	1	x	1.47	x	53.61	x	0.63	x	0.7	=	31.28	(82)
Rooflights 0.9x	1	x	0.86	x	92.46	x	0.63	x	0.7	=	31.56	(82)
Rooflights 0.9x	1	x	1.47	x	92.46	x	0.63	x	0.7	=	53.95	(82)
Rooflights 0.9x	1	x	0.86	x	141.46	x	0.63	x	0.7	=	48.28	(82)
Rooflights 0.9x	1	x	1.47	x	141.46	x	0.63	x	0.7	=	82.53	(82)
Rooflights 0.9x	1	x	0.86	x	179.27	x	0.63	x	0.7	=	61.19	(82)
Rooflights 0.9x	1	x	1.47	x	179.27	x	0.63	x	0.7	=	104.6	(82)
Rooflights 0.9x	1	x	0.86	x	186.15	x	0.63	x	0.7	=	63.54	(82)
Rooflights 0.9x	1	x	1.47	x	186.15	x	0.63	x	0.7	=	108.61	(82)
Rooflights 0.9x	1	x	0.86	x	176.14	x	0.63	x	0.7	=	60.12	(82)
Rooflights 0.9x	1	x	1.47	x	176.14	x	0.63	x	0.7	=	102.77	(82)
Rooflights 0.9x	1	x	0.86	x	147.33	x	0.63	x	0.7	=	50.29	(82)
Rooflights 0.9x	1	x	1.47	x	147.33	x	0.63	x	0.7	=	85.96	(82)
Rooflights 0.9x	1	x	0.86	x	109.68	x	0.63	x	0.7	=	37.44	(82)
Rooflights 0.9x	1	x	1.47	x	109.68	x	0.63	x	0.7	=	63.99	(82)
Rooflights 0.9x	1	x	0.86	x	64.71	x	0.63	x	0.7	=	22.09	(82)
Rooflights 0.9x	1	x	1.47	x	64.71	x	0.63	x	0.7	=	37.75	(82)
Rooflights 0.9x	1	x	0.86	x	33.41	x	0.63	x	0.7	=	11.41	(82)
Rooflights 0.9x	1	x	1.47	x	33.41	x	0.63	x	0.7	=	19.49	(82)
Rooflights 0.9x	1	x	0.86	x	21.65	x	0.63	x	0.7	=	7.39	(82)
Rooflights 0.9x	1	x	1.47	x	21.65	x	0.63	x	0.7	=	12.63	(82)

Solar gains in watts, calculated for each month

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

(83)m=	133.01	235.8	342.43	449.75	521.43	523.93	502.63	449.18	380.12	266.4	161.11	112.61	(83)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

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

(84)m=	687.92	786.55	872.99	949.03	988.74	962.54	924.4	878.86	827.75	745.52	675.24	653.16	(84)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

7. From internal temperature (Table 9a)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.96	0.94	0.9	0.83	0.72	0.57	0.43	0.47	0.67	0.86	0.94	0.97	(86)

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

(87)m=	19.28	19.53	19.89	20.33	20.67	20.89	20.96	20.95	20.81	20.35	19.74	19.23	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.82	19.82	19.83	19.84	19.84	19.85	19.85	19.85	19.84	19.84	19.83	19.83	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.95	0.93	0.88	0.8	0.67	0.49	0.33	0.36	0.59	0.82	0.93	0.96	(89)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(90)m=	17.59	17.94	18.46	19.06	19.51	19.76	19.83	19.82	19.68	19.11	18.26	17.52	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.46 (91)

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

SAP WorkSheet: New dwelling design stage

(92)m=	18.36	18.66	19.11	19.63	20.04	20.27	20.35	20.34	20.19	19.68	18.93	18.3	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(93)m=	18.36	18.66	19.11	19.63	20.04	20.27	20.35	20.34	20.19	19.68	18.93	18.3	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

9 Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	0.94	0.91	0.87	0.79	0.68	0.52	0.38	0.41	0.62	0.82	0.91	0.95	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	645.94	717.87	758.44	751.26	668.51	500.77	347.6	361.5	510.22	608.65	615.97	617.99	(95)
--------	--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1376.92	1345.3	1230.42	1038.09	804.96	543.46	358.79	376.63	585.41	876.46	1146.17	1370.29	(97)
--------	---------	--------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	543.84	421.63	351.16	206.52	101.52	0	0	0	0	199.25	381.74	559.72	
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 2765.39 (98)

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

37.37 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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

Fraction of total heating from main system 1 (204) = (202) \times [1 - (203)] = 1 (204)

Efficiency of main space heating system 1 100 (206)

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

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

Space heating requirement (calculated above)

543.84	421.63	351.16	206.52	101.52	0	0	0	0	199.25	381.74	559.72
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

543.84	421.63	351.16	206.52	101.52	0	0	0	0	199.25	381.74	559.72
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total ($kWh/year$) = $Sum(211)_{1..5,9..12} =$ 2765.39 (211)

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

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

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

Total ($kWh/year$) = $Sum(215)_{1..5,9..12} =$ 0 (215)

Water heating

Output from water heater (calculated above)

179.9	158.3	165.62	147.61	144.02	127.79	121.87	134.91	135.04	153.1	162.97	175.28
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Efficiency of water heater 100 (216)

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

Fuel for water heating, $kWh/month$

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

(219)m=	179.9	158.3	165.62	147.61	144.02	127.79	121.87	134.91	135.04	153.1	162.97	175.28	
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Total = $Sum(219a)_{1..12} =$ 1806.41 (219)

SAP WorkSheet: New dwelling design stage

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2765.39
Water heating fuel used		1806.41
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0 (231)
Electricity for lighting		333.28 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4905.07 (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 = 364.75 (240)
Space heating - main system 2	{213} x	0	x 0.01 = 0 (241)
Space heating - secondary	{215} x	13.19	x 0.01 = 0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	{219} x (243) x	13.19	x 0.01 = 238.27 (245)
Low-rate cost	{219} x (244) x	13.19	x 0.01 = 0 (246)
Pumps, fans and electric keep-hot	{231}	13.19	x 0.01 = 0 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	{232}	13.19	x 0.01 = 43.96 (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) =	646.98 (255)
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11a SAP rating – individual heating systems

Energy cost deflator (Table 12)		0.42 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	2.28 (257)
SAP rating (Section 12)		68.15 (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	= 1435.24 (261)
Space heating (secondary)	{215} x	0.519	= 0 (263)
Water heating	{219} x	0.519	= 937.53 (264)
Space and water heating	{261} + (262) + (263) + (264) =		2372.76 (265)
Electricity for pumps, fans and electric keep-hot	{231} x	0.519	= 0 (267)
Electricity for lighting	{232} x	0.519	= 172.97 (268)

SAP WorkSheet: New dwelling design stage

Total CO2, kg/year	sum of (265)...(271) =	2545.73	(272)
CO2 emissions per m²	(272) ÷ (4) =	34.4	(273)
El rating (section 14)		71	(274)

13a Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	8489.74	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5545.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =			14035.41	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	0	(267)
Electricity for lighting	(232) x	0	=	1023.16	(268)
'Total Primary Energy		sum of (265)...(271) =		15058.58	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		203.49	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 16 June 2021 at 14:43:17

Project Information:

Assessed By: Joe Solti (STRO003946)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 63.77m²

Site Reference : YI-47

Plot Reference: YI4703A

Address : Unit 3, 107 Felpham Way, Felpham, PO22 8QB

Client Details:

Name: Pickup Town Planning

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) 27.58 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 9.58 kg/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 49.9 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 45.2 kWh/m² OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.34 (max. 0.70)	OK
Party wall	0.20 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.38 (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	6.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Room heaters - electric
Panel, convector or radiant heaters

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.80 kWh/day Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	No primary pipework	

Regulations Compliance Report

6 Controls

Space heating controls	Programmer and appliance thermostats	OK
Hot water controls:	Cylinderstat	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
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Based on:

Overshading:	Average or unknown
Windows facing: North	0.4m ²
Windows facing: South	0.4m ²
Windows facing: East	1.6m ²
Windows facing: West	0.9m ²
Windows facing: West	3.8m ²
Roof windows facing: East	0.86m ²
Roof windows facing: West	1.47m ²
Ventilation rate:	3.00
Blinds/curtains:	None

10 Key features

Floors U-value	0.09 W/m ² K
Photovoltaic array	

SAP Input

Property Details: Y04703A

Address: Unit 3, 107 Felpham Way, Felpham, PO22 8QB
Located in: England
Region: South East England
UPRN:
Date of assessment: 16 June 2021
Date of certificate: 16 June 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Calculated 177.47
Water use <= 125 litres/ person/ day: True
PCDF Version: 478

Property description

Dwelling type: Flat
Detachment:
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 63.77 m² 2.373 m
Living area: 27.9 m² (fraction 0.438)
Front of dwelling faces: South

Opening types

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Solid	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (N)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (S)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (E)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (W)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
French Doors	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Rooflights (E)	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood
Rooflights (W)	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	16mm or more mm	0.7	0.63	1.4	1.9	1
Windows (N)	16mm or more	0.7	0.63	1.4	0.4	1
Windows (S)	16mm or more	0.7	0.63	1.4	0.4	1
Windows (E)	16mm or more	0.7	0.63	1.4	1.6	1
Windows (W)	16mm or more	0.7	0.63	1.4	0.9	1
French Doors	16mm or more	0.7	0.63	1.4	3.8	1
Rooflights (E)	16mm or more	0.7	0.63	1.3	0.86	1
Rooflights (W)	16mm or more	0.7	0.63	1.3	1.47	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall (common)	South	0	0
Windows (N)		Wall (external)	North	0	0
Windows (S)		Wall (external)	South	0	0
Windows (E)		Wall (external)	East	0	0
Windows (W)		Wall (external)	West	0	0
French Doors		Wall (external)	West	0	0
Rooflights (E)		Roof	East	0.001	0
Rooflights (W)		Roof	West	0.001	0

SAP Input

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall (external)	57.4	7.1	50.3	0.17	0	False	150
Wall (common)	17.1	1.9	15.2	0.5	0.9	False	14
Roof	65.3	2.33	62.97	0.13	0		9
Roof (flat)	2.1	0	2.1	0.18	0		9
Exposed Floor	2.1			0.18			20
Floor (Commercial)	2.7			0.09			20
<u>Internal Elements</u>							
Walls	115						9
<u>Party Elements</u>							
Party Wall	3.8						20
Party Floor	58.9						30

Thermal Bridges:

Thermal bridges:	User-defined (individual PSI-values) Y-Value = 0.0427			
	Length	Psi-value		
	5.7	0.022	E2	Other lintels (including other steel lintels)
	3.1	0.032	E3	Sill
	19.8	0.018	E4	Jamb
	0	0.064	E5	Ground floor (normal)
[Approved]	0	0.06	E10	Eaves (insulation at ceiling level)
[Approved]	15.4	0.04	E11	Eaves (insulation at rafter level)
[Approved]	0	0.24	E12	Gable (insulation at ceiling level)
[Approved]	8.3	0.04	E13	Gable (insulation at rafter level)
[Approved]	10.2	0.09	E16	Corner (normal)
[Approved]	4.3	0.06	E18	Party wall between dwellings
	9.6	0.32	E20	Exposed floor (normal)
	4.4	0.08	E14	Flat roof
	1.7	0.08	P5	Roof (insulation at rafter level)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	2
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	6

Main heating system:

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

Main heating Control:

SAP Input

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

Secondary heating system

Secondary heating system: None

Water heating

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 180 litres
Cylinder insulation: Measured loss, 1.8kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Single
Solar panel: False

Others

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Low rise urban / suburban
EPC language: English
Wind turbine: No
Photovoltaics: Photovoltaic 1
Installed Peak power: 4.5
Tilt of collector: 30°
Overshading: None or very little
Collector Orientation: West
Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: 44/03A

Address : Unit 3, 107 Felpham Way, Felpham, PO22 8QB

1. General dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	63.77 (1a)	2.37 (2a)	151.33 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.77 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	151.33 (5)

2. Ventilation rate

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) ÷ (10) ÷ (11) ÷ (12) ÷ (13) ÷ (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			6 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.43 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.33 (21)

Infiltration rate modified for monthly wind speed

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

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

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

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.59 0.59 0.58 0.57 0.56 0.55 0.55 0.55 0.56 0.56 0.57 0.58 (24d)

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

(25)m= 0.59 0.59 0.58 0.57 0.56 0.55 0.55 0.55 0.56 0.56 0.57 0.58 (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			1.9	1.4	2.66		(26)
Windows Type 1			0.4	$\times 1/[1/(1.4) + 0.04]$	0.53		(27)
Windows Type 2			0.4	$\times 1/[1/(1.4) + 0.04]$	0.53		(27)
Windows Type 3			1.6	$\times 1/[1/(1.4) + 0.04]$	2.12		(27)
Windows Type 4			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 5			3.8	$\times 1/[1/(1.4) + 0.04]$	5.04		(27)
Rooflights Type 1			0.86	$\times 1/[1/(1.3) + 0.04]$	1.118		(27b)
Rooflights Type 2			1.47	$\times 1/[1/(1.3) + 0.04]$	1.911		(27b)
Floor Type 1			2.1	0.18	0.378	20	42 (28)
Floor Type 2			2.7	0.09	0.243	20	54 (28)
Walls Type1	57.4	7.1	50.3	0.17	8.55	150	7545 (29)
Walls Type2	17.1	1.9	15.2	0.34	5.24	14	212.8 (29)
Roof Type1	65.3	2.33	62.97	0.13	8.19	9	566.73 (30)
Roof Type2	2.1	0	2.1	0.18	0.38	9	18.9 (30)
Total area of elements, m²			146.7				(31)
Party wall			3.8	0.2	0.76	20	76 (32)
Party floor			58.9			30	1767 (32a)
Internal wall **			115			9	1035 (32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 38.69 (33)

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Heat capacity $C_m = S(A \times k)$

$\{(28) \dots (30) + (32) + (32a) \dots (32e)\} =$ 11317.43 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in $\text{kJ/m}^2\text{K}$

$= \{(34) \div (4)\} =$ 177.47 (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 : $S (L \times Y)$ calculated using Appendix K

6.26 (36)

if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss

$\{(33) + (36)\} =$ 44.95 (37)

Ventilation heat loss calculated monthly

$\{(38)m = 0.33 \times (25)m \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
$\{(38)m =$	29.52	29.35	29.17	28.36	28.21	27.5	27.5	27.37	27.77	28.21	28.51	28.84	$\}$ (38)

Heat transfer coefficient, W/K

$\{(39)m = (37) + (38)m$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
$\{(39)m =$	74.48	74.3	74.13	73.31	73.16	72.45	72.45	72.32	72.72	73.16	73.47	73.79	
Average = $\text{Sum}\{(39)\}_{1..12} / 12 =$												73.31	$\}$ (39)

Heat loss parameter (HLP), $\text{W/m}^2\text{K}$

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
$\{(40)m =$	1.17	1.17	1.16	1.15	1.15	1.14	1.14	1.13	1.14	1.15	1.15	1.16	
Average = $\text{Sum}\{(40)\}_{1..12} / 12 =$												1.15	$\}$ (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement

kWh/year

Assumed occupancy, N

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

if $TFA \leq 13.9$, $N = 1$

2.09 (42)

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

83.74 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
$\{(44)m =$	92.12	88.77	85.42	82.07	78.72	75.37	75.37	78.72	82.07	85.42	88.77	92.12	
Total = $\text{Sum}\{(44)\}_{1..12} =$												1004.9	$\}$ (44)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
$\{(45)m =$	136.61	119.48	123.29	107.49	103.14	89	82.47	94.64	95.77	111.61	121.83	132.3	
Total = $\text{Sum}\{(45)\}_{1..12} =$												1317.59	$\}$ (45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
$\{(46)m =$	20.49	17.92	18.49	16.12	15.47	13.35	12.37	14.2	14.36	16.74	18.27	19.84	$\}$ (46)

Water storage loss:

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

180 (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):

1.8 (48)

Temperature factor from Table 2b

0.6 (49)

Energy lost from water storage, kWh/year

$\{(48) \times (49)\} =$ 1.08 (50)

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

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Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
If community heating see section 4.3		
Volume factor from Table 2a	0	(52)
Temperature factor from Table 2b	0	(53)
Energy lost from water storage, kWh/year	$(47) \times (51) \times (52) \times (53) =$	(54)
Enter (50) or (54) in (55)	1.08	(55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

(56)m=	33.48	30.24	33.48	32.4	33.48	32.4	33.48	33.48	32.4	33.48	32.4	33.48	(56)
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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	33.48	30.24	33.48	32.4	33.48	32.4	33.48	33.48	32.4	33.48	32.4	33.48	(57)
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Primary circuit loss (annual) from Table 3	0	(58)
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Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

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

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

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

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

(62)m=	170.09	149.72	156.77	139.89	136.62	121.4	115.95	128.12	128.17	145.09	154.23	165.78	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

Output from water heater

(64)m=	170.09	149.72	156.77	139.89	136.62	121.4	115.95	128.12	128.17	145.09	154.23	165.78	
Output from water heater (annual):...12												1711.79	(64)

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

(65)m=	72.21	63.92	67.78	61.66	61.08	55.51	54.21	58.25	57.76	63.89	66.43	70.77	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	125.16	125.16	125.16	125.16	125.16	125.16	125.16	125.16	125.16	125.16	125.16	125.16	(66)

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

(67)m=	42.65	37.88	30.81	23.32	17.43	14.72	15.9	20.67	27.75	35.23	41.12	43.84	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	272.16	274.98	267.86	252.71	233.59	215.61	203.61	200.78	207.9	223.05	242.17	260.15	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	(69)
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Pumps and fans gains (Table 5a)

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

(71)m=	-83.44	-83.44	-83.44	-83.44	-83.44	-83.44	-83.44	-83.44	-83.44	-83.44	-83.44	-83.44	(71)
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Water heating gains (Table 5)

(72)m=	97.05	95.12	91.1	85.64	82.09	77.1	72.86	78.29	80.23	85.88	92.26	95.12	(72)
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Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	503.18	499.3	481.09	453	424.44	398.75	383.69	391.07	407.19	435.48	466.88	490.43	(73)
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6. Solar gains

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
North	0.9x 0.77	x 0.4	x 10.63	x 0.63	x 0.7	= 1.3 (74)
North	0.9x 0.77	x 0.4	x 20.32	x 0.63	x 0.7	= 2.48 (74)
North	0.9x 0.77	x 0.4	x 34.53	x 0.63	x 0.7	= 4.22 (74)
North	0.9x 0.77	x 0.4	x 55.46	x 0.63	x 0.7	= 6.78 (74)
North	0.9x 0.77	x 0.4	x 74.72	x 0.63	x 0.7	= 9.13 (74)
North	0.9x 0.77	x 0.4	x 79.99	x 0.63	x 0.7	= 9.78 (74)
North	0.9x 0.77	x 0.4	x 74.68	x 0.63	x 0.7	= 9.13 (74)
North	0.9x 0.77	x 0.4	x 59.25	x 0.63	x 0.7	= 7.24 (74)
North	0.9x 0.77	x 0.4	x 41.52	x 0.63	x 0.7	= 5.08 (74)
North	0.9x 0.77	x 0.4	x 24.19	x 0.63	x 0.7	= 2.96 (74)
North	0.9x 0.77	x 0.4	x 13.12	x 0.63	x 0.7	= 1.6 (74)
North	0.9x 0.77	x 0.4	x 8.86	x 0.63	x 0.7	= 1.08 (74)
East	0.9x 0.77	x 1.6	x 19.64	x 0.63	x 0.7	= 9.6 (76)
East	0.9x 0.77	x 1.6	x 38.42	x 0.63	x 0.7	= 18.79 (76)
East	0.9x 0.77	x 1.6	x 63.27	x 0.63	x 0.7	= 30.94 (76)
East	0.9x 0.77	x 1.6	x 92.28	x 0.63	x 0.7	= 45.12 (76)
East	0.9x 0.77	x 1.6	x 113.09	x 0.63	x 0.7	= 55.3 (76)
East	0.9x 0.77	x 1.6	x 115.77	x 0.63	x 0.7	= 56.61 (76)
East	0.9x 0.77	x 1.6	x 110.22	x 0.63	x 0.7	= 53.89 (76)
East	0.9x 0.77	x 1.6	x 94.68	x 0.63	x 0.7	= 46.29 (76)
East	0.9x 0.77	x 1.6	x 73.59	x 0.63	x 0.7	= 35.98 (76)
East	0.9x 0.77	x 1.6	x 45.59	x 0.63	x 0.7	= 22.29 (76)
East	0.9x 0.77	x 1.6	x 24.49	x 0.63	x 0.7	= 11.97 (76)
East	0.9x 0.77	x 1.6	x 16.15	x 0.63	x 0.7	= 7.9 (76)
South	0.9x 0.77	x 0.4	x 46.75	x 0.63	x 0.7	= 5.72 (78)
South	0.9x 0.77	x 0.4	x 76.57	x 0.63	x 0.7	= 9.36 (78)
South	0.9x 0.77	x 0.4	x 97.53	x 0.63	x 0.7	= 11.92 (78)
South	0.9x 0.77	x 0.4	x 110.23	x 0.63	x 0.7	= 13.48 (78)
South	0.9x 0.77	x 0.4	x 114.87	x 0.63	x 0.7	= 14.04 (78)
South	0.9x 0.77	x 0.4	x 110.55	x 0.63	x 0.7	= 13.51 (78)
South	0.9x 0.77	x 0.4	x 108.01	x 0.63	x 0.7	= 13.2 (78)
South	0.9x 0.77	x 0.4	x 104.89	x 0.63	x 0.7	= 12.82 (78)
South	0.9x 0.77	x 0.4	x 101.89	x 0.63	x 0.7	= 12.46 (78)
South	0.9x 0.77	x 0.4	x 82.59	x 0.63	x 0.7	= 10.1 (78)

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South	0.9x	0.77	x	0.4	x	55.42	x	0.63	x	0.7	=	6.77	(78)
South	0.9x	0.77	x	0.4	x	40.4	x	0.63	x	0.7	=	4.94	(78)
West	0.9x	0.77	x	0.9	x	19.64	x	0.63	x	0.7	=	5.4	(80)
West	0.9x	0.77	x	3.8	x	19.64	x	0.63	x	0.7	=	22.81	(80)
West	0.9x	0.77	x	0.9	x	38.42	x	0.63	x	0.7	=	10.57	(80)
West	0.9x	0.77	x	3.8	x	38.42	x	0.63	x	0.7	=	44.62	(80)
West	0.9x	0.77	x	0.9	x	63.27	x	0.63	x	0.7	=	17.4	(80)
West	0.9x	0.77	x	3.8	x	63.27	x	0.63	x	0.7	=	73.48	(80)
West	0.9x	0.77	x	0.9	x	92.28	x	0.63	x	0.7	=	25.38	(80)
West	0.9x	0.77	x	3.8	x	92.28	x	0.63	x	0.7	=	107.17	(80)
West	0.9x	0.77	x	0.9	x	113.09	x	0.63	x	0.7	=	31.11	(80)
West	0.9x	0.77	x	3.8	x	113.09	x	0.63	x	0.7	=	131.34	(80)
West	0.9x	0.77	x	0.9	x	115.77	x	0.63	x	0.7	=	31.84	(80)
West	0.9x	0.77	x	3.8	x	115.77	x	0.63	x	0.7	=	134.45	(80)
West	0.9x	0.77	x	0.9	x	110.22	x	0.63	x	0.7	=	30.32	(80)
West	0.9x	0.77	x	3.8	x	110.22	x	0.63	x	0.7	=	128	(80)
West	0.9x	0.77	x	0.9	x	94.68	x	0.63	x	0.7	=	26.04	(80)
West	0.9x	0.77	x	3.8	x	94.68	x	0.63	x	0.7	=	109.95	(80)
West	0.9x	0.77	x	0.9	x	73.59	x	0.63	x	0.7	=	20.24	(80)
West	0.9x	0.77	x	3.8	x	73.59	x	0.63	x	0.7	=	85.46	(80)
West	0.9x	0.77	x	0.9	x	45.59	x	0.63	x	0.7	=	12.54	(80)
West	0.9x	0.77	x	3.8	x	45.59	x	0.63	x	0.7	=	52.94	(80)
West	0.9x	0.77	x	0.9	x	24.49	x	0.63	x	0.7	=	6.74	(80)
West	0.9x	0.77	x	3.8	x	24.49	x	0.63	x	0.7	=	28.44	(80)
West	0.9x	0.77	x	0.9	x	16.15	x	0.63	x	0.7	=	4.44	(80)
West	0.9x	0.77	x	3.8	x	16.15	x	0.63	x	0.7	=	18.76	(80)
Rooflights	0.9x	1	x	0.86	x	26.56	x	0.63	x	0.7	=	9.07	(82)
Rooflights	0.9x	1	x	1.47	x	26.56	x	0.63	x	0.7	=	15.5	(82)
Rooflights	0.9x	1	x	0.86	x	53.61	x	0.63	x	0.7	=	18.3	(82)
Rooflights	0.9x	1	x	1.47	x	53.61	x	0.63	x	0.7	=	31.28	(82)
Rooflights	0.9x	1	x	0.86	x	92.46	x	0.63	x	0.7	=	31.56	(82)
Rooflights	0.9x	1	x	1.47	x	92.46	x	0.63	x	0.7	=	53.95	(82)
Rooflights	0.9x	1	x	0.86	x	141.46	x	0.63	x	0.7	=	48.28	(82)
Rooflights	0.9x	1	x	1.47	x	141.46	x	0.63	x	0.7	=	82.53	(82)
Rooflights	0.9x	1	x	0.86	x	179.27	x	0.63	x	0.7	=	61.19	(82)
Rooflights	0.9x	1	x	1.47	x	179.27	x	0.63	x	0.7	=	104.6	(82)
Rooflights	0.9x	1	x	0.86	x	186.15	x	0.63	x	0.7	=	63.54	(82)
Rooflights	0.9x	1	x	1.47	x	186.15	x	0.63	x	0.7	=	108.61	(82)
Rooflights	0.9x	1	x	0.86	x	176.14	x	0.63	x	0.7	=	60.12	(82)
Rooflights	0.9x	1	x	1.47	x	176.14	x	0.63	x	0.7	=	102.77	(82)
Rooflights	0.9x	1	x	0.86	x	147.33	x	0.63	x	0.7	=	50.29	(82)

SAP WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	1.47	x	147.33	x	0.63	x	0.7	=	85.96	(82)
Rooflights 0.9x	1	x	0.86	x	109.68	x	0.63	x	0.7	=	37.44	(82)
Rooflights 0.9x	1	x	1.47	x	109.68	x	0.63	x	0.7	=	63.99	(82)
Rooflights 0.9x	1	x	0.86	x	64.71	x	0.63	x	0.7	=	22.09	(82)
Rooflights 0.9x	1	x	1.47	x	64.71	x	0.63	x	0.7	=	37.75	(82)
Rooflights 0.9x	1	x	0.86	x	33.41	x	0.63	x	0.7	=	11.41	(82)
Rooflights 0.9x	1	x	1.47	x	33.41	x	0.63	x	0.7	=	19.49	(82)
Rooflights 0.9x	1	x	0.86	x	21.65	x	0.63	x	0.7	=	7.39	(82)
Rooflights 0.9x	1	x	1.47	x	21.65	x	0.63	x	0.7	=	12.63	(82)

Solar gains in watts, calculated for each month

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

{83}m=	69.39	135.4	223.47	328.74	406.71	418.34	397.43	338.6	260.65	160.67	86.43	57.14	(83)
--------	-------	-------	--------	--------	--------	--------	--------	-------	--------	--------	-------	-------	------

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

{84}m=	572.57	634.7	704.57	781.74	831.15	817.09	781.12	729.67	667.84	596.15	553.3	547.57	(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=	0.97	0.96	0.92	0.84	0.71	0.54	0.4	0.44	0.67	0.88	0.95	0.98	(86)

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

{87}m=	19.69	19.88	20.19	20.56	20.83	20.95	20.99	20.98	20.9	20.55	20.06	19.65	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

{88}m=	19.95	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

{89}m=	0.97	0.95	0.9	0.81	0.65	0.46	0.31	0.35	0.59	0.85	0.94	0.97	(89)
--------	------	------	-----	------	------	------	------	------	------	------	------	------	------

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

{90}m=	18.24	18.51	18.95	19.46	19.79	19.94	19.97	19.96	19.88	19.46	18.78	18.19	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.44 (91)

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

{92}m=	18.87	19.11	19.49	19.94	20.24	20.38	20.41	20.41	20.33	19.93	19.34	18.83	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

{93}m=	18.87	19.11	19.49	19.94	20.24	20.38	20.41	20.41	20.33	19.93	19.34	18.83	(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=	0.96	0.94	0.9	0.81	0.67	0.49	0.35	0.39	0.62	0.84	0.93	0.96	(94)
--------	------	------	-----	------	------	------	------	------	------	------	------	------	------

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

{95}m=	547.84	595.04	631.12	631.49	556.35	403.24	273.16	285.19	414.81	503.5	517.08	526.89	(95)
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Monthly average external temperature from Table 8

{96}m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

{97}m=	1085.42	1055.51	962.89	809.5	625.04	419	276.3	290.04	452.75	682.82	899	1079.59	(97)
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SAP WorkSheet: New dwelling design stage

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

(98)m=	399.96	309.44	246.84	128.16	51.11	0	0	0	0	133.41	274.99	411.2	
Total per year (kWh/year) = Sum(98) _{1...12} =													1955.11 (98)

Space heating requirement in kWh/m²/year

30.66 (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		100 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

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

Space heating requirement (calculated above)

399.96	309.44	246.84	128.16	51.11	0	0	0	0	133.41	274.99	411.2
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(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

399.96	309.44	246.84	128.16	51.11	0	0	0	0	133.41	274.99	411.2
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Total (kWh/year) = Sum(211)_{1...12} = 1955.11 (211)

Space heating fuel (secondary), kWh/month

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

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

Water heating

Output from water heater (calculated above)

170.09	149.72	156.77	139.89	136.62	121.4	115.95	128.12	128.17	145.09	154.23	165.78
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Efficiency of water heater 100 (216)

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

Fuel for water heating, kWh/month

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

(219)m=	170.09	149.72	156.77	139.89	136.62	121.4	115.95	128.12	128.17	145.09	154.23	165.78
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Total = Sum(219a)_{1...12} = 1711.79 (219)

Annual totals

Space heating fuel used, main system 1 kWh/year 1955.11

Water heating fuel used kWh/year 1711.79

Electricity for pumps, fans and electric keep-hot

Total electricity for the above, kWh/year sum of (230a)...(230g) = 0 (231)

Electricity for lighting 301.29 (232)

Electricity generated by PVs -3268.28 (233)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 699.91 (338)

10a Fuel costs - individual heating systems

Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
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SAP WorkSheet: New dwelling design stage

Space heating - main system 1	{211} x	13.19	x 0.01 =	257.88	{240}
Space heating - main system 2	{213} x	0	x 0.01 =	0	{241}
Space heating - secondary	{215} x	13.19	x 0.01 =	0	{242}
Water heating (electric off-peak tariff)					
High-rate fraction (Table 13, or Appendix F for electric CPSU)				1	{243}
Low-rate fraction	1.0 - {243} =			0	{244}
High-rate cost	{219} x {243} x	13.19	x 0.01 =	225.78	{245}
Low-rate cost	{219} x {244} x	13.19	x 0.01 =	0	{246}
Pumps, fans and electric keep-hot	{231}	13.19	x 0.01 =	0	{249}
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a)					
Energy for lighting	{232}	13.19	x 0.01 =	39.74	{250}
Additional standing charges (Table 12)				0	{251}
	one of {233} to {235} x)	13.19	x 0.01 =	-431.09	{252}

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

Total energy cost {245}...{247} + {250}...{254} = 92.32 {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] =	0.36	{257}
SAP rating (Section 12)		95.03	{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	= 1014.7 {261}
Space heating (secondary)	{215} x	0.519	= 0 {263}
Water heating	{219} x	0.519	= 888.42 {264}
Space and water heating	{261} + {262} + {263} + {264} =		1903.12 {265}
Electricity for pumps, fans and electric keep-hot	{231} x	0.519	= 0 {267}
Electricity for lighting	{232} x	0.519	= 156.37 {268}
Energy saving/generation technologies			
Item 1		0.519	= -1696.23 {269}
Total CO2, kg/year		sum of {265}...{271} =	363.25 {272}
CO2 emissions per m²		{272} ÷ (4) =	5.7 {273}
EI rating (section 14)			96 {274}

13a Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	{211} x	3.07	= 6002.2 {261}

SAP WorkSheet: New dwelling design stage

Space heating (secondary)	{215} x	3.07	=	0	{263}
Energy for water heating	{219} x	3.07	=	5255.19	{264}
Space and water heating	{261} + {262} + {263} + {264} =			11257.38	{265}
Electricity for pumps, fans and electric keep-hot	{231} x	3.07	=	0	{267}
Electricity for lighting	{232} x	0	=	924.95	{268}
Energy saving/generation technologies Item 1		3.07	=	-10033.61	{269}
'Total Primary Energy		sum of {265}...{271} =		2148.73	{272}
Primary energy kWh/m²/year		{272} ÷ {4} =		33.7	{273}

Block Compliance WorkSheet: 107 Felpham Way, Felpham (YI-47A)

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP **Software Version:** Version: 1.0.5.41

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
YI4701A	39.21	30.3	49.6	57.2	61.05
YI4702A	37.83	29.89	51.8	61.3	74
YI4703A	9.58	27.58	45.2	49.9	63.77

Calculation Summary

Total Floor Area	198.82
Average TER	29.27
Average DER	29.19
Average DFEE	49.01
Average TFEE	56.38
Compliance	Pass
% Improvement DER TER	0.27
% Improvement DFEE TFEE	13.07