

Regulations Compliance Report



Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 29 July 2021 at 16:01:37

Project Information

Assessed By: Nick Gill (STRO034854) **Building Type:** Detached House

Dwelling Details

NEW DWELLING DESIGN STAGE Total Floor Area: 149.74m²
Site Reference : 1 Orchard Way **Plot Reference:** Plot 1
Address : Plot 1, Orchard Way, Fontwell, BN18 0SH

Client Details

Name: nb architects
Address : unit 5 level 4 south, new england house, brighton, bn1 4gh

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.27 kg/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.49 kg/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 58.8 kWh/m²
Dwelling Fabric Energy Efficiency (DFEE) 52.6 kWh/m² OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.23 (max. 0.70)	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.24 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas
Data from manufacturer
Efficiency 89.2 % SEDBUK2009
Minimum 88.0 % OK

Secondary heating system: Room heaters - wood
Closed room heater
Efficiency 65.0 %
Minimum 65.0 % OK

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.60 kWh/day
Permitted by DBSCG: 2.30 kWh/day OK

Regulations Compliance Report



Primary pipework insulated: Yes OK

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system
Specific fan power: 0.74
Maximum 1.5 OK
MVHR efficiency: 89%
Minimum 70% OK

9 Summer time temperature

Overheating risk (South East England): Slight OK

Based on:

Overshading: Average or unknown
Windows facing: South West 4.8m²
Windows facing: North West 1.05m²
Windows facing: North West 1.56m²
Windows facing: North East 8.4m²
Windows facing: South West 0.72m²
Windows facing: South West 1.44m²
Windows facing: South West 1.44m²
Windows facing: South East 2.88m²
Windows facing: North East 1.8m²
Windows facing: North East 1.8m²
Roof windows facing: North West 0.43m²
Roof windows facing: South East 1.31m²
Roof windows facing: South East 0.76m²
Ventilation rate: 4.00
Blinds/curtains: Dark-coloured curtain or roller blind
Closed 100% of daylight hours

10 Key features

Photovoltaic array
Secondary heating (wood logs)
Secondary heating fuel wood logs

Predicted Energy Assessment



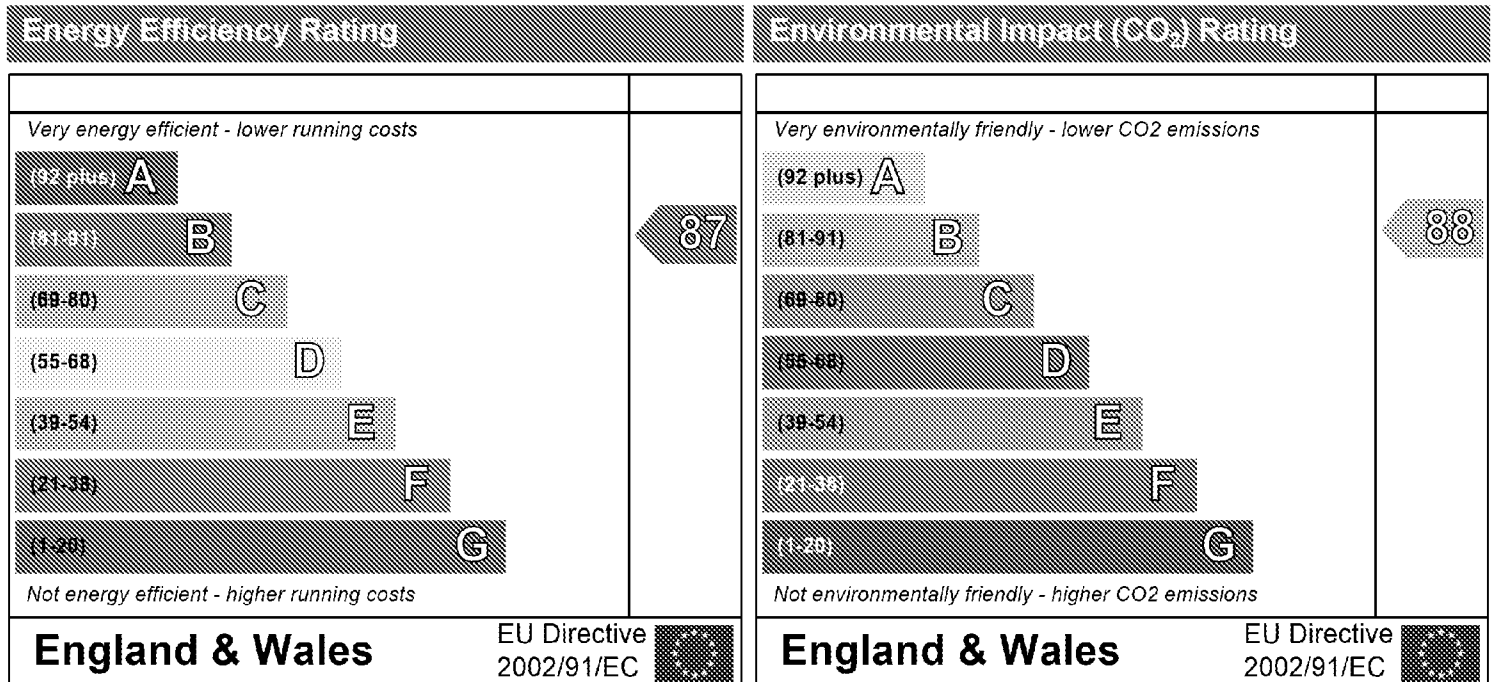
Plot 1
Orchard Way
Fontwell
BN18 0SH

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Detached House
27 July 2021
Nick Gill
149.74 m²

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

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



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

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

SAP Input



Property Details: Plot 1

Address: Plot 1, Orchard Way, Fontwell, BN18 0SH
Located in: England
Region: South East England
UPRN:
Date of assessment: 27 July 2021
Date of certificate: 29 July 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Low
Water use <= 125 litres/person/day: True
PCDF Version: 480

Property description

Dwelling type: House
Detachment: Detached
Year Completed: 2021

Floor Location:

Floor area:

Storey height:

Floor 0	87.4 m ²	2.4 m
Floor 1	62.34 m ²	2.6 m

Living area: 31 m² (fraction 0.207)
Front of dwelling faces: South West

Opening details

Name:	Source:	Type:	Glazing:	Argon:	Frame:
EXW01	Manufacturer	Solid			Wood
EXW02	Manufacturer	Solid			Wood
GW01	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
GW02	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
GW04	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
FSD01	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
GW03	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
FW01	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
FW02	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
FW03	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
FW04	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
FW05	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
V01	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood
V02	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood
V03	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
EXW01	mm	0.7	0	1.4	3.57	1
EXW02	mm	0.7	0	1.4	2.06	1
GW01	16mm or more	0.7	0.63	1.2	4.8	1
GW02	16mm or more	0.7	0.63	1.2	1.05	1
GW04	16mm or more	0.7	0.63	1.2	1.56	1
FSD01	16mm or more	0.7	0.63	1.2	8.4	1
GW03	16mm or more	0.7	0.63	1.2	0.72	1
FW01	16mm or more	0.7	0.63	1.2	1.44	1
FW02	16mm or more	0.7	0.63	1.2	1.44	1
FW03	16mm or more	0.7	0.63	1.2	1.44	2
FW04	16mm or more	0.7	0.63	1.2	1.8	1

SAP Input



FW05	16mm or more	0.7	0.63	1.2	1.8	1
V01	16mm or more	0.7	0.63	1.3	0.429	1
V02	16mm or more	0.7	0.63	1.3	1.3132	1
V03	16mm or more	0.7	0.63	1.3	0.7644	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
EXW01		Rendered walls	South West	1.7	2.1
EXW02		Rendered walls	North East	0.98	2.1
GW01		Rendered walls	South West	3.2	1.5
GW02		Rendered walls	North West	0.7	1.5
GW04		Rendered walls	North West	2.4	0.65
FSD01		Brickwork walls	North East	4	2.1
GW03		Rendered walls	South West	0.6	1.2
FW01		Rendered walls	South West	1.2	1.2
FW02		Rendered walls	South West	1.2	1.2
FW03		Rendered walls	South East	1.2	1.2
FW04		Rendered walls	North East	1.5	1.2
FW05		Rendered walls	North East	1.5	1.2
V01		Sloped roofs	North West	0.55	0.78
V02		Sloped roofs	South East	1.34	0.98
V03		Sloped roofs	South East	0.78	0.98

Overshading: Average or unknown

Graphic Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Plinth walls	14.17	0	14.17	0.23	0	False	N/A
Brickwork walls	25.2	8.4	16.8	0.23	0	False	N/A
Rendered walls	152.68	23.12	129.56	0.21	0	False	N/A
Sloped roofs	17.5	2.51	14.99	0.14	0		N/A
Flat roof	18.2	0	18.2	0.14	0		N/A
Pitched GF roof	6.85	0	6.85	0.14	0		N/A
Main roof	52.34	0	52.34	0.14	0		N/A
Ground floor	87.4			0.17			N/A
<u>Internal Elements</u>							
Solid internal walls	48.4						N/A
Internal stud walls	15.2						N/A
GF ceiling	71.85						N/A
First Floor	32.27						N/A
<u>Party Elements</u>							

Thermal Bridges

Thermal bridges:		User-defined (individual PSI-values) Y-Value = 0.0429			
		Length	Psi-value		
		21.38	0.055	E1	Steel lintel with perforated steel base plate
	[Approved]	18.7	0.04	E3	Sill
	[Approved]	36.7	0.05	E4	Jamb
	[Approved]	47.23	0.16	E5	Ground floor (normal)
	[Approved]	17.15	0.07	E6	Intermediate floor within a dwelling
	[Approved]	24.8	0.04	E11	Eaves (insulation at rafter level)
	[Approved]	6.95	0.04	E13	Gable (insulation at rafter level)
	[Approved]	24.5	0.09	E16	Corner (normal)
	[Approved]	9.6	-0.09	E17	Corner (inverted internal area greater than external area)
		11.5	0.08	E14	Flat roof

Ventilation:

Pressure test: Yes (As designed)

SAP Input



Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 4
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 1 (main: 0, secondary: 0, other: 1)
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Manufacturer Declaration
Manufacturer's data
Efficiency: 89.2% (SEDBUK2009)
Regular condensing with automatic ignition
Fuel Burning Type:
Underfloor heating and radiators, pipes in screed above insulation
Central heating pump : 2013 or later
Design flow temperature: Unknown
Boiler interlock: Yes
Delayed start

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2110

Secondary heating system:

Secondary heating system: Room heaters
Solid fuel room heaters
Fuel :wood logs
Info Source: SAP Tables
Closed room heater
HETAS Approved

Water heating:

Water heating: From main heating system
Water code: 901
Fuel :mains gas
Hot water cylinder
Cylinder volume: 210 litres
Cylinder insulation: Measured loss, 1.6kWh/day
Primary pipework insulation: True
Cylinderstat: True
Cylinder in heated space: True
Solar panel: False

Other:

Electricity tariff: Standard Tariff
In Smoke Control Area: No
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Rural
EPC language: English
Wind turbine: No

SAP Input



Photovoltaics:

Photovoltaic 1

Installed Peak power: 1.35

Tilt of collector: 45°

Overshading: None or very little

Collector Orientation: South East

Assess Zero Carbon Home:

No



Base Details

Assessor Name: Nick Gill **Stroma Number:** STRO034854
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Plot 1

Address : Plot 1, Orchard Way, Fontwell, BN18 0SH

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	87.4 (1a) ×	2.4 (2a) =	209.76 (3a)
First floor	62.34 (1b) ×	2.6 (2b) =	162.08 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	149.74 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	371.84 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	1	1	40 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (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) =	40	+ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
If both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 × (14) + 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) + 20]÷(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 × (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (20) =		0.3 (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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SAP WorkSheet: New dwelling design stage



Wind Factor (22a)m = (22)m ÷ 4

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

	0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

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

0.5	(23b)
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If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

75.65	(23c)
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a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.51	0.5	0.49	0.46	0.45	0.41	0.41	0.4	0.43	0.45	0.46	0.48	(24a)
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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)
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)
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d) If natural ventilation or whole house positive input ventilation from loft

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.51	0.5	0.49	0.46	0.45	0.41	0.41	0.4	0.43	0.45	0.46	0.48	(25)
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U-value and A X U calculator

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			3.57	1.4	4.998		(26)
Doors Type 2			2.06	1.4	2.884		(26)
Windows Type 1			4.8	$\times 1/[1/(1.2) + 0.04]$	5.5		(27)
Windows Type 2			1.05	$\times 1/[1/(1.2) + 0.04]$	1.2		(27)
Windows Type 3			1.56	$\times 1/[1/(1.2) + 0.04]$	1.79		(27)
Windows Type 4			8.4	$\times 1/[1/(1.2) + 0.04]$	9.62		(27)
Windows Type 5			0.72	$\times 1/[1/(1.2) + 0.04]$	0.82		(27)
Windows Type 6			1.44	$\times 1/[1/(1.2) + 0.04]$	1.65		(27)
Windows Type 7			1.44	$\times 1/[1/(1.2) + 0.04]$	1.65		(27)
Windows Type 8			1.44	$\times 1/[1/(1.2) + 0.04]$	1.65		(27)
Windows Type 9			1.8	$\times 1/[1/(1.2) + 0.04]$	2.06		(27)
Windows Type 10			1.8	$\times 1/[1/(1.2) + 0.04]$	2.06		(27)
Rooflights Type 1			0.429	$\times 1/[1/(1.3) + 0.04]$	0.5577		(27b)
Rooflights Type 2			1.3132	$\times 1/[1/(1.3) + 0.04]$	1.70716		(27b)
Rooflights Type 3			0.7644	$\times 1/[1/(1.3) + 0.04]$	0.99372		(27b)
Floor			87.4	0.17	14.858		(28)
Walls Type1	14.17	0	14.17	0.23	3.26		(29)



SAP WorkSheet: New dwelling design stage

Walls Type2	25.2	8.4	16.8	×	0.23	=	3.86		(29)
Walls Type3	152.68	23.12	129.56	×	0.21	=	27.21		(29)
Roof Type1	17.5	2.51	14.99	×	0.14	=	2.1		(30)
Roof Type2	18.2	0	18.2	×	0.14	=	2.55		(30)
Roof Type3	6.85	0	6.85	×	0.14	=	0.96		(30)
Roof Type4	52.34	0	52.34	×	0.14	=	7.33		(30)
Total area of elements, m ²			374.34						(31)
Internal wall **			48.4						(32c)
Internal wall **			15.2						(32c)
Internal floor			32.27						(32d)
Internal ceiling			71.85						(32e)

* 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) = 102.75 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 22012.56 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 16.05 (36)

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

Total fabric heat loss (33) + (36) = 118.79 (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	62.49	61.56	60.63	55.96	55.03	50.37	50.37	49.44	52.24	55.03	56.9	58.76	(38)

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

(39)m	181.29	180.35	179.42	174.76	173.83	169.16	169.16	168.23	171.03	173.83	175.69	177.56	
													174.53 (39)

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

(40)m	1.21	1.2	1.2	1.17	1.16	1.13	1.13	1.12	1.14	1.16	1.17	1.19	
													1.17 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirements

Non-year

Assumed occupancy, N 2.93 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 103.88 (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	114.27	110.11	105.95	101.8	97.64	93.49	93.49	97.64	101.8	105.95	110.11	114.27	
													Total = Sum(44) _{1..12} = 1246.53 (44)

SAP WorkSheet: New dwelling design stage



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

(45)m=	169.45	148.2	152.93	133.33	127.93	110.4	102.3	117.39	118.79	138.44	151.12	164.11		
Total = Sum(45) _{1..12} =													1634.39	(45)

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

(46)m=	25.42	22.23	22.94	20	19.19	16.56	15.34	17.61	17.82	20.77	22.67	24.62	
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	210	(47)
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If community heating and no tank in dwelling, enter 110 litres in (47)

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):	1.6	(48)
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Temperature factor from Table 2b	0.54	(49)
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Energy lost from water storage, kWh/year	(48) × (49) =	0.86	(50)
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b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
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If community heating see section 4.3

Volume factor from Table 2a	0	(52)
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Temperature factor from Table 2b	0	(53)
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Energy lost from water storage, kWh/year	(47) × (51) × (52) × (53) =	0	(54)
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Enter (50) or (54) in (55)	0.86	(55)
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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

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

(57)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	
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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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	
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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	
--------	---	---	---	---	---	---	---	---	---	---	---	---	--

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=	219.5	193.41	202.98	181.76	177.98	158.83	152.35	167.44	167.22	188.49	199.55	214.15	
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

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	
--------	---	---	---	---	---	---	---	---	---	---	---	---	--

Output from water heater

(64)m=	219.5	193.41	202.98	181.76	177.98	158.83	152.35	167.44	167.22	188.49	199.55	214.15		
Output from water heater (annual) =													2223.65	(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=	96.38	85.44	90.89	83.08	82.58	75.45	74.05	79.07	78.24	86.07	88.99	94.6	
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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

Heat gains from solar thermal panels and solar

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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SAP WorkSheet: New dwelling design stage



(66)m=	176.03	176.03	176.03	176.03	176.03	176.03	176.03	176.03	176.03	176.03	176.03	176.03
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(66)

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

(67)m=	72.17	64.1	52.13	39.47	29.5	24.91	26.91	34.98	46.95	59.62	69.58	74.18
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(67)

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

(68)m=	477.97	482.93	470.43	443.82	410.24	378.67	357.58	352.62	365.12	391.72	425.31	456.88
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(68)

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

(69)m=	55.54	55.54	55.54	55.54	55.54	55.54	55.54	55.54	55.54	55.54	55.54	55.54
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(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3
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(70)

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

(71)m=	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35
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(71)

Water heating gains (Table 5)

(72)m=	129.54	127.14	122.16	115.39	110.99	104.8	99.53	106.28	108.67	115.68	123.6	127.15
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(72)

Total internal gains =

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

(73)m=	796.89	791.39	761.93	715.89	667.94	625.58	601.23	611.09	637.95	684.24	735.71	775.42
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(73)

6. SOLAR GAINS

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	8.4	x	11.28	x	0.63	x	0.7	=	28.96	(75)
Northeast 0.9x	0.77	x	1.8	x	11.28	x	0.63	x	0.7	=	6.21	(75)
Northeast 0.9x	0.77	x	1.8	x	11.28	x	0.63	x	0.7	=	6.21	(75)
Northeast 0.9x	0.77	x	8.4	x	22.97	x	0.63	x	0.7	=	58.96	(75)
Northeast 0.9x	0.77	x	1.8	x	22.97	x	0.63	x	0.7	=	12.63	(75)
Northeast 0.9x	0.77	x	1.8	x	22.97	x	0.63	x	0.7	=	12.63	(75)
Northeast 0.9x	0.77	x	8.4	x	41.38	x	0.63	x	0.7	=	106.23	(75)
Northeast 0.9x	0.77	x	1.8	x	41.38	x	0.63	x	0.7	=	22.76	(75)
Northeast 0.9x	0.77	x	1.8	x	41.38	x	0.63	x	0.7	=	22.76	(75)
Northeast 0.9x	0.77	x	8.4	x	67.96	x	0.63	x	0.7	=	174.45	(75)
Northeast 0.9x	0.77	x	1.8	x	67.96	x	0.63	x	0.7	=	37.38	(75)
Northeast 0.9x	0.77	x	1.8	x	67.96	x	0.63	x	0.7	=	37.38	(75)
Northeast 0.9x	0.77	x	8.4	x	91.35	x	0.63	x	0.7	=	234.5	(75)
Northeast 0.9x	0.77	x	1.8	x	91.35	x	0.63	x	0.7	=	50.25	(75)
Northeast 0.9x	0.77	x	1.8	x	91.35	x	0.63	x	0.7	=	50.25	(75)
Northeast 0.9x	0.77	x	8.4	x	97.38	x	0.63	x	0.7	=	250	(75)
Northeast 0.9x	0.77	x	1.8	x	97.38	x	0.63	x	0.7	=	53.57	(75)
Northeast 0.9x	0.77	x	1.8	x	97.38	x	0.63	x	0.7	=	53.57	(75)
Northeast 0.9x	0.77	x	8.4	x	91.1	x	0.63	x	0.7	=	233.87	(75)
Northeast 0.9x	0.77	x	1.8	x	91.1	x	0.63	x	0.7	=	50.12	(75)
Northeast 0.9x	0.77	x	1.8	x	91.1	x	0.63	x	0.7	=	50.12	(75)

SAP WorkSheet: New dwelling design stage



Northeast 0.9x	0.77	x	8.4	x	72.63	x	0.63	x	0.7	=	186.44	(75)
Northeast 0.9x	0.77	x	1.8	x	72.63	x	0.63	x	0.7	=	39.95	(75)
Northeast 0.9x	0.77	x	1.8	x	72.63	x	0.63	x	0.7	=	39.95	(75)
Northeast 0.9x	0.77	x	8.4	x	50.42	x	0.63	x	0.7	=	129.44	(75)
Northeast 0.9x	0.77	x	1.8	x	50.42	x	0.63	x	0.7	=	27.74	(75)
Northeast 0.9x	0.77	x	1.8	x	50.42	x	0.63	x	0.7	=	27.74	(75)
Northeast 0.9x	0.77	x	8.4	x	28.07	x	0.63	x	0.7	=	72.05	(75)
Northeast 0.9x	0.77	x	1.8	x	28.07	x	0.63	x	0.7	=	15.44	(75)
Northeast 0.9x	0.77	x	1.8	x	28.07	x	0.63	x	0.7	=	15.44	(75)
Northeast 0.9x	0.77	x	8.4	x	14.2	x	0.63	x	0.7	=	36.45	(75)
Northeast 0.9x	0.77	x	1.8	x	14.2	x	0.63	x	0.7	=	7.81	(75)
Northeast 0.9x	0.77	x	1.8	x	14.2	x	0.63	x	0.7	=	7.81	(75)
Northeast 0.9x	0.77	x	8.4	x	9.21	x	0.63	x	0.7	=	23.65	(75)
Northeast 0.9x	0.77	x	1.8	x	9.21	x	0.63	x	0.7	=	5.07	(75)
Northeast 0.9x	0.77	x	1.8	x	9.21	x	0.63	x	0.7	=	5.07	(75)
Southeast 0.9x	0.77	x	1.44	x	36.79	x	0.63	x	0.7	=	32.38	(77)
Southeast 0.9x	0.77	x	1.44	x	62.67	x	0.63	x	0.7	=	55.16	(77)
Southeast 0.9x	0.77	x	1.44	x	85.75	x	0.63	x	0.7	=	75.48	(77)
Southeast 0.9x	0.77	x	1.44	x	106.25	x	0.63	x	0.7	=	93.52	(77)
Southeast 0.9x	0.77	x	1.44	x	119.01	x	0.63	x	0.7	=	104.75	(77)
Southeast 0.9x	0.77	x	1.44	x	118.15	x	0.63	x	0.7	=	103.99	(77)
Southeast 0.9x	0.77	x	1.44	x	113.91	x	0.63	x	0.7	=	100.26	(77)
Southeast 0.9x	0.77	x	1.44	x	104.39	x	0.63	x	0.7	=	91.88	(77)
Southeast 0.9x	0.77	x	1.44	x	92.85	x	0.63	x	0.7	=	81.73	(77)
Southeast 0.9x	0.77	x	1.44	x	69.27	x	0.63	x	0.7	=	60.97	(77)
Southeast 0.9x	0.77	x	1.44	x	44.07	x	0.63	x	0.7	=	38.79	(77)
Southeast 0.9x	0.77	x	1.44	x	31.49	x	0.63	x	0.7	=	27.71	(77)
Southwest 0.9x	0.77	x	4.8	x	36.79		0.63	x	0.7	=	53.97	(79)
Southwest 0.9x	0.77	x	0.72	x	36.79		0.63	x	0.7	=	8.1	(79)
Southwest 0.9x	0.77	x	1.44	x	36.79		0.63	x	0.7	=	16.19	(79)
Southwest 0.9x	0.77	x	1.44	x	36.79		0.63	x	0.7	=	16.19	(79)
Southwest 0.9x	0.77	x	4.8	x	62.67		0.63	x	0.7	=	91.94	(79)
Southwest 0.9x	0.77	x	0.72	x	62.67		0.63	x	0.7	=	13.79	(79)
Southwest 0.9x	0.77	x	1.44	x	62.67		0.63	x	0.7	=	27.58	(79)
Southwest 0.9x	0.77	x	1.44	x	62.67		0.63	x	0.7	=	27.58	(79)
Southwest 0.9x	0.77	x	4.8	x	85.75		0.63	x	0.7	=	125.79	(79)
Southwest 0.9x	0.77	x	0.72	x	85.75		0.63	x	0.7	=	18.87	(79)
Southwest 0.9x	0.77	x	1.44	x	85.75		0.63	x	0.7	=	37.74	(79)
Southwest 0.9x	0.77	x	1.44	x	85.75		0.63	x	0.7	=	37.74	(79)
Southwest 0.9x	0.77	x	4.8	x	106.25		0.63	x	0.7	=	155.87	(79)
Southwest 0.9x	0.77	x	0.72	x	106.25		0.63	x	0.7	=	23.38	(79)

SAP WorkSheet: New dwelling design stage



Southwest0.9x	0.77	x	1.44	x	106.25	0.63	x	0.7	=	46.76	(79)
Southwest0.9x	0.77	x	1.44	x	106.25	0.63	x	0.7	=	46.76	(79)
Southwest0.9x	0.77	x	4.8	x	119.01	0.63	x	0.7	=	174.58	(79)
Southwest0.9x	0.77	x	0.72	x	119.01	0.63	x	0.7	=	26.19	(79)
Southwest0.9x	0.77	x	1.44	x	119.01	0.63	x	0.7	=	52.37	(79)
Southwest0.9x	0.77	x	1.44	x	119.01	0.63	x	0.7	=	52.37	(79)
Southwest0.9x	0.77	x	4.8	x	118.15	0.63	x	0.7	=	173.32	(79)
Southwest0.9x	0.77	x	0.72	x	118.15	0.63	x	0.7	=	26	(79)
Southwest0.9x	0.77	x	1.44	x	118.15	0.63	x	0.7	=	52	(79)
Southwest0.9x	0.77	x	1.44	x	118.15	0.63	x	0.7	=	52	(79)
Southwest0.9x	0.77	x	4.8	x	113.91	0.63	x	0.7	=	167.1	(79)
Southwest0.9x	0.77	x	0.72	x	113.91	0.63	x	0.7	=	25.06	(79)
Southwest0.9x	0.77	x	1.44	x	113.91	0.63	x	0.7	=	50.13	(79)
Southwest0.9x	0.77	x	1.44	x	113.91	0.63	x	0.7	=	50.13	(79)
Southwest0.9x	0.77	x	4.8	x	104.39	0.63	x	0.7	=	153.13	(79)
Southwest0.9x	0.77	x	0.72	x	104.39	0.63	x	0.7	=	22.97	(79)
Southwest0.9x	0.77	x	1.44	x	104.39	0.63	x	0.7	=	45.94	(79)
Southwest0.9x	0.77	x	1.44	x	104.39	0.63	x	0.7	=	45.94	(79)
Southwest0.9x	0.77	x	4.8	x	92.85	0.63	x	0.7	=	136.21	(79)
Southwest0.9x	0.77	x	0.72	x	92.85	0.63	x	0.7	=	20.43	(79)
Southwest0.9x	0.77	x	1.44	x	92.85	0.63	x	0.7	=	40.86	(79)
Southwest0.9x	0.77	x	1.44	x	92.85	0.63	x	0.7	=	40.86	(79)
Southwest0.9x	0.77	x	4.8	x	69.27	0.63	x	0.7	=	101.61	(79)
Southwest0.9x	0.77	x	0.72	x	69.27	0.63	x	0.7	=	15.24	(79)
Southwest0.9x	0.77	x	1.44	x	69.27	0.63	x	0.7	=	30.48	(79)
Southwest0.9x	0.77	x	1.44	x	69.27	0.63	x	0.7	=	30.48	(79)
Southwest0.9x	0.77	x	4.8	x	44.07	0.63	x	0.7	=	64.65	(79)
Southwest0.9x	0.77	x	0.72	x	44.07	0.63	x	0.7	=	9.7	(79)
Southwest0.9x	0.77	x	1.44	x	44.07	0.63	x	0.7	=	19.39	(79)
Southwest0.9x	0.77	x	1.44	x	44.07	0.63	x	0.7	=	19.39	(79)
Southwest0.9x	0.77	x	4.8	x	31.49	0.63	x	0.7	=	46.19	(79)
Southwest0.9x	0.77	x	0.72	x	31.49	0.63	x	0.7	=	6.93	(79)
Southwest0.9x	0.77	x	1.44	x	31.49	0.63	x	0.7	=	13.86	(79)
Southwest0.9x	0.77	x	1.44	x	31.49	0.63	x	0.7	=	13.86	(79)
Northwest0.9x	0.77	x	1.05	x	11.28	0.63	x	0.7	=	3.62	(81)
Northwest0.9x	0.77	x	1.56	x	11.28	0.63	x	0.7	=	5.38	(81)
Northwest0.9x	0.77	x	1.05	x	22.97	0.63	x	0.7	=	7.37	(81)
Northwest0.9x	0.77	x	1.56	x	22.97	0.63	x	0.7	=	10.95	(81)
Northwest0.9x	0.77	x	1.05	x	41.38	0.63	x	0.7	=	13.28	(81)
Northwest0.9x	0.77	x	1.56	x	41.38	0.63	x	0.7	=	19.73	(81)
Northwest0.9x	0.77	x	1.05	x	67.96	0.63	x	0.7	=	21.81	(81)

SAP WorkSheet: New dwelling design stage



Northwest 0.9x	0.77	x	1.56	x	67.96	x	0.63	x	0.7	=	32.4	(81)
Northwest 0.9x	0.77	x	1.05	x	91.35	x	0.63	x	0.7	=	29.31	(81)
Northwest 0.9x	0.77	x	1.56	x	91.35	x	0.63	x	0.7	=	43.55	(81)
Northwest 0.9x	0.77	x	1.05	x	97.38	x	0.63	x	0.7	=	31.25	(81)
Northwest 0.9x	0.77	x	1.56	x	97.38	x	0.63	x	0.7	=	46.43	(81)
Northwest 0.9x	0.77	x	1.05	x	91.1	x	0.63	x	0.7	=	29.23	(81)
Northwest 0.9x	0.77	x	1.56	x	91.1	x	0.63	x	0.7	=	43.43	(81)
Northwest 0.9x	0.77	x	1.05	x	72.63	x	0.63	x	0.7	=	23.31	(81)
Northwest 0.9x	0.77	x	1.56	x	72.63	x	0.63	x	0.7	=	34.63	(81)
Northwest 0.9x	0.77	x	1.05	x	50.42	x	0.63	x	0.7	=	16.18	(81)
Northwest 0.9x	0.77	x	1.56	x	50.42	x	0.63	x	0.7	=	24.04	(81)
Northwest 0.9x	0.77	x	1.05	x	28.07	x	0.63	x	0.7	=	9.01	(81)
Northwest 0.9x	0.77	x	1.56	x	28.07	x	0.63	x	0.7	=	13.38	(81)
Northwest 0.9x	0.77	x	1.05	x	14.2	x	0.63	x	0.7	=	4.56	(81)
Northwest 0.9x	0.77	x	1.56	x	14.2	x	0.63	x	0.7	=	6.77	(81)
Northwest 0.9x	0.77	x	1.05	x	9.21	x	0.63	x	0.7	=	2.96	(81)
Northwest 0.9x	0.77	x	1.56	x	9.21	x	0.63	x	0.7	=	4.39	(81)
Rooflights 0.9x	1	x	0.43	x	16.37	x	0.63	x	0.7	=	2.79	(82)
Rooflights 0.9x	1	x	1.31	x	39.98	x	0.63	x	0.7	=	20.84	(82)
Rooflights 0.9x	1	x	0.76	x	39.98	x	0.63	x	0.7	=	12.13	(82)
Rooflights 0.9x	1	x	0.43	x	33.68	x	0.63	x	0.7	=	5.74	(82)
Rooflights 0.9x	1	x	1.31	x	73.48	x	0.63	x	0.7	=	38.3	(82)
Rooflights 0.9x	1	x	0.76	x	73.48	x	0.63	x	0.7	=	22.29	(82)
Rooflights 0.9x	1	x	0.43	x	62.13	x	0.63	x	0.7	=	10.58	(82)
Rooflights 0.9x	1	x	1.31	x	112.11	x	0.63	x	0.7	=	58.43	(82)
Rooflights 0.9x	1	x	0.76	x	112.11	x	0.63	x	0.7	=	34.01	(82)
Rooflights 0.9x	1	x	0.43	x	104.87	x	0.63	x	0.7	=	17.86	(82)
Rooflights 0.9x	1	x	1.31	x	153.81	x	0.63	x	0.7	=	80.17	(82)
Rooflights 0.9x	1	x	0.76	x	153.81	x	0.63	x	0.7	=	46.66	(82)
Rooflights 0.9x	1	x	0.43	x	143.66	x	0.63	x	0.7	=	24.46	(82)
Rooflights 0.9x	1	x	1.31	x	182.63	x	0.63	x	0.7	=	95.19	(82)
Rooflights 0.9x	1	x	0.76	x	182.63	x	0.63	x	0.7	=	55.41	(82)
Rooflights 0.9x	1	x	0.43	x	154.33	x	0.63	x	0.7	=	26.28	(82)
Rooflights 0.9x	1	x	1.31	x	184.99	x	0.63	x	0.7	=	96.42	(82)
Rooflights 0.9x	1	x	0.76	x	184.99	x	0.63	x	0.7	=	56.13	(82)
Rooflights 0.9x	1	x	0.43	x	143.9	x	0.63	x	0.7	=	24.5	(82)
Rooflights 0.9x	1	x	1.31	x	176.88	x	0.63	x	0.7	=	92.19	(82)
Rooflights 0.9x	1	x	0.76	x	176.88	x	0.63	x	0.7	=	53.67	(82)
Rooflights 0.9x	1	x	0.43	x	113.05	x	0.63	x	0.7	=	19.25	(82)
Rooflights 0.9x	1	x	1.31	x	155.4	x	0.63	x	0.7	=	80.99	(82)
Rooflights 0.9x	1	x	0.76	x	155.4	x	0.63	x	0.7	=	47.15	(82)

SAP WorkSheet: New dwelling design stage



Rooflights 0.9x	1	x	0.43	x	76.56	x	0.63	x	0.7	=	13.04	(82)
Rooflights 0.9x	1	x	1.31	x	126.86	x	0.63	x	0.7	=	66.12	(82)
Rooflights 0.9x	1	x	0.76	x	126.86	x	0.63	x	0.7	=	38.49	(82)
Rooflights 0.9x	1	x	0.43	x	41.49	x	0.63	x	0.7	=	7.07	(82)
Rooflights 0.9x	1	x	1.31	x	84.6	x	0.63	x	0.7	=	44.09	(82)
Rooflights 0.9x	1	x	0.76	x	84.6	x	0.63	x	0.7	=	25.67	(82)
Rooflights 0.9x	1	x	0.43	x	20.65	x	0.63	x	0.7	=	3.52	(82)
Rooflights 0.9x	1	x	1.31	x	48.93	x	0.63	x	0.7	=	25.5	(82)
Rooflights 0.9x	1	x	0.76	x	48.93	x	0.63	x	0.7	=	14.84	(82)
Rooflights 0.9x	1	x	0.43	x	13.34	x	0.63	x	0.7	=	2.27	(82)
Rooflights 0.9x	1	x	1.31	x	33.5	x	0.63	x	0.7	=	17.46	(82)
Rooflights 0.9x	1	x	0.76	x	33.5	x	0.63	x	0.7	=	10.16	(82)

Solar gains in watts, calculated for each month

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

(83)m=	212.97	384.93	583.4	814.4	993.19	1020.95	969.81	831.53	662.86	440.93	259.18	179.58	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1009.86	1176.32	1345.33	1530.28	1661.12	1646.53	1571.04	1442.62	1300.81	1125.17	994.88	955	(84)
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	--------	-----	------

7. Mean internal temperature in living area (85) to (90)

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	0.71	0.56	0.44	0.48	0.69	0.87	0.94	0.96	(86)

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

(87)m=	19.09	19.31	19.67	20.14	20.51	20.76	20.85	20.83	20.64	20.15	19.56	19.07	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.91	19.92	19.92	19.95	19.95	19.98	19.98	19.98	19.97	19.95	19.94	19.93	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.95	0.93	0.89	0.8	0.67	0.49	0.35	0.39	0.62	0.84	0.93	0.96	(89)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(90)m=	17.36	17.68	18.2	18.87	19.37	19.7	19.79	19.79	19.57	18.91	18.06	17.35	(90)
--------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.21

(91)

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

(92)m=	17.72	18.02	18.5	19.13	19.61	19.92	20.01	20	19.79	19.17	18.37	17.7	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.57	17.87	18.35	18.98	19.46	19.77	19.86	19.85	19.64	19.02	18.22	17.55	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating calculation

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

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

Utilisation factor for gains, hm:

(94)m=	0.93	0.9	0.86	0.77	0.64	0.48	0.34	0.38	0.6	0.81	0.91	0.94	(94)
--------	------	-----	------	------	------	------	------	------	-----	------	------	------	------

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

(95)m=	941.42	1064.27	1153.41	1178.33	1068.55	788.75	528.6	548.33	783.12	910.03	900.73	897.21	(95)
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SAP WorkSheet: New dwelling design stage



Monthly average external temperature from Table 8

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

(97)m=	2404.78	2339.15	2126.68	1762.38	1348.77	874.52	551.73	580.65	947.3	1463.09	1953.25	2370.84	(97)
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Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	1088.74	856.72	724.11	420.52	208.49	0	0	0	0	411.48	757.82	1096.38	(98)
--------	---------	--------	--------	--------	--------	---	---	---	---	--------	--------	---------	------

Total per year (kWh/year) = $\text{Sum}(98)_{1..12} =$ 5564.25 (98)

Space heating requirement in kWh/m²/year

37.16 (99)

Energy requirements for individual heating systems including solar (200)

Space heating:

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

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

Fraction of total heating from main system 1 (204) = $(202) \times [1 - (203)] =$ 0.9 (204)

Efficiency of main space heating system 1 90.1 (206)

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

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

Space heating requirement (calculated above)

1088.74	856.72	724.11	420.52	208.49	0	0	0	0	411.48	757.82	1096.38
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(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

1087.53	855.77	723.31	420.05	208.25	0	0	0	0	411.02	756.98	1095.16
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Total (kWh/year) = $\text{Sum}(211)_{1..12} =$ 5558.07 (211)

Space heating fuel (secondary), kWh/month

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

(215)m=	167.5	131.8	111.4	64.69	32.07	0	0	0	0	63.3	116.59	168.67	(215)
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Total (kWh/year) = $\text{Sum}(215)_{1..12} =$ 856.04 (215)

Water heating

Output from water heater (calculated above)

219.5	193.41	202.98	181.76	177.98	158.83	152.35	167.44	167.22	188.49	199.55	214.15
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Efficiency of water heater 80 (216)

(217)m=	88.07	87.88	87.48	86.55	84.88	80	80	80	80	86.42	87.6	88.12	(217)
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Fuel for water heating, kWh/month

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

(219)m=	249.25	220.09	232.04	210	209.68	198.54	190.43	209.3	209.03	218.11	227.81	243.03	(219)
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Total = $\text{Sum}(219a)_{1..12} =$ 2617.29 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1 5558.07

Space heating fuel used, secondary 856.04

Water heating fuel used 2617.29

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside 419.63 (230a)

central heating pump: 30 (230c)

SAP WorkSheet: New dwelling design stage



Total electricity for the above, kWh/year	sum of (230a)...(230g) =	449.63	(231)
Electricity for lighting		509.81	(232)
Electricity generated by PVs		-1084.32	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		8906.52	(338)

19a Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48	193.42 (240)
Space heating - main system 2	(213) x	0	0 (241)
Space heating - secondary	(215) x	4.23	36.21 (242)
Water heating cost (other fuel)	(219)	3.48	91.08 (247)
Pumps, fans and electric keep-hot	(231)	13.19	59.31 (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	67.24 (250)
Additional standing charges (Table 12)			120 (251)
	one of (233) to (235) x	13.19	-143.02 (252)

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

Total energy cost	(245)...(247) + (250)...(254) =	424.24	(255)
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19b SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	0.91	(257)
SAP rating (Section 12)		87.24	(258)

19c CO2 emissions - individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	1200.54 (261)
Space heating (secondary)	(215) x	0.019	16.26 (263)
Water heating	(219) x	0.216	565.33 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1782.14 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	233.36 (267)
Electricity for lighting	(232) x	0.519	264.59 (268)
Energy saving/generation technologies			
Item 1		0.519	-562.76 (269)
Total CO2, kg/year	sum of (265) ..(271) =		1717.33 (272)
CO2 emissions per m²	(272) ÷ (4) =		11.47 (273)
EI rating (section 14)			88 (274)

SAP WorkSheet: New dwelling design stage



13a Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) ×	1.22	≡	6780.85	(261)
Space heating (secondary)	(215) ×	1.04	≡	890.28	(263)
Energy for water heating	(219) ×	1.22	≡	3193.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			10864.22	(265)
Electricity for pumps, fans and electric keep-hot	(231) ×	3.07	≡	1380.35	(267)
Electricity for lighting	(232) ×	0	≡	1565.13	(268)
Energy saving/generation technologies Item 1		3.07	≡	-3328.85	(269)
'Total Primary Energy		sum of (265)...(271) =		10480.85	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		69.99	(273)



Base Details

Assessor Name: Nick Gill **Stroma Number:** STRO034854
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Plot 1

Address : Plot 1, Orchard Way, Fontwell, BN18 0SH

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	87.4 (1a) ×	2.4 (2a) =	209.76 (3a)
First floor	62.34 (1b) ×	2.6 (2b) =	162.08 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	149.74 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	371.84 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	1	1	40 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (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) =	40	× (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
If both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 × (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] × (8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 × (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (20) =		0.3 (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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DER WorkSheet: New dwelling design stage



Wind Factor (22a)m = (22)m ÷ 4

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

	0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m=	0.51	0.5	0.49	0.46	0.45	0.41	0.41	0.4	0.43	0.45	0.46	0.48
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(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
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(24b)

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

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(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 × 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24d)

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

(25)m=	0.51	0.5	0.49	0.46	0.45	0.41	0.41	0.4	0.43	0.45	0.46	0.48
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(25)

U-value calculator

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			3.57	1.4	4.998		(26)
Doors Type 2			2.06	1.4	2.884		(26)
Windows Type 1			4.8	$\times 1/[1/(1.2) + 0.04]$	5.5		(27)
Windows Type 2			1.05	$\times 1/[1/(1.2) + 0.04]$	1.2		(27)
Windows Type 3			1.56	$\times 1/[1/(1.2) + 0.04]$	1.79		(27)
Windows Type 4			8.4	$\times 1/[1/(1.2) + 0.04]$	9.62		(27)
Windows Type 5			0.72	$\times 1/[1/(1.2) + 0.04]$	0.82		(27)
Windows Type 6			1.44	$\times 1/[1/(1.2) + 0.04]$	1.65		(27)
Windows Type 7			1.44	$\times 1/[1/(1.2) + 0.04]$	1.65		(27)
Windows Type 8			1.44	$\times 1/[1/(1.2) + 0.04]$	1.65		(27)
Windows Type 9			1.8	$\times 1/[1/(1.2) + 0.04]$	2.06		(27)
Windows Type 10			1.8	$\times 1/[1/(1.2) + 0.04]$	2.06		(27)
Rooflights Type 1			0.429	$\times 1/[1/(1.3) + 0.04]$	0.5577		(27b)
Rooflights Type 2			1.3132	$\times 1/[1/(1.3) + 0.04]$	1.70716		(27b)
Rooflights Type 3			0.7644	$\times 1/[1/(1.3) + 0.04]$	0.99372		(27b)
Floor			87.4	0.17	14.858		(28)
Walls Type1	14.17	0	14.17	0.23	3.26		(29)

DER WorkSheet: New dwelling design stage



Walls Type2	25.2	8.4	16.8	×	0.23	=	3.86		(29)
Walls Type3	152.68	23.12	129.56	×	0.21	=	27.21		(29)
Roof Type1	17.5	2.51	14.99	×	0.14	=	2.1		(30)
Roof Type2	18.2	0	18.2	×	0.14	=	2.55		(30)
Roof Type3	6.85	0	6.85	×	0.14	=	0.96		(30)
Roof Type4	52.34	0	52.34	×	0.14	=	7.33		(30)
Total area of elements, m ²			374.34						(31)
Internal wall **			48.4						(32c)
Internal wall **			15.2						(32c)
Internal floor			32.27						(32d)
Internal ceiling			71.85						(32e)

* 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) =	102.75	(33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	22012.56	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	Indicative Value: Low	100	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		16.05	(36)
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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	118.79	(37)
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Ventilation heat loss calculated monthly	(38)m = 0.33 x (25)m x (5)		
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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	62.49	61.56	60.63	55.96	55.03	50.37	50.37	49.44	52.24	55.03	56.9	58.76	(38)

Heat transfer coefficient, W/K												(39)m = (37) + (38)m		
(39)m=	181.29	180.35	179.42	174.76	173.83	169.16	169.16	168.23	171.03	173.83	175.69	177.56		
Average = Sum(39) _{1...12} / 12=													174.53	(39)

Heat loss parameter (HLP), W/m²K											(40)m = (39)m + (4)			
(40)m=	1.21	1.2	1.2	1.17	1.16	1.13	1.13	1.12	1.14	1.16	1.17	1.19		
Average = Sum(40) _{1...12} / 12 =													1.17	(40)

Number of days in month (Table 1a)													
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating supply & demand

Assumed occupancy, N	2.93	(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9) ²)] + 0.0013 x (TFA - 13.9)		
if TFA ≤ 13.9, N = 1		

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	103.88	(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	114.27	110.11	105.95	101.8	97.64	93.49	93.49	97.64	101.8	105.95	110.11	114.27	
	Total = Sum(44) _{1...12} =											1246.53	(44)

DER WorkSheet: New dwelling design stage



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

(45)m=	169.45	148.2	152.93	133.33	127.93	110.4	102.3	117.39	118.79	138.44	151.12	164.11	
Total = Sum(45) _{1..12} =													1634.39 (45)

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

(46)m=	25.42	22.23	22.94	20	19.19	16.56	15.34	17.61	17.82	20.77	22.67	24.62	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	210	(47)
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If community heating and no tank in dwelling, enter 110 litres in (47)

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):	1.6	(48)
---	-----	------

Temperature factor from Table 2b	0.54	(49)
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Energy lost from water storage, kWh/year	(48) × (49) =	0.86	(50)
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b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
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If community heating see section 4.3

Volume factor from Table 2a	0	(52)
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Temperature factor from Table 2b	0	(53)
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Energy lost from water storage, kWh/year	(47) × (51) × (52) × (53) =	0	(54)
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Enter (50) or (54) in (55)	0.86	(55)
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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(56)
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If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) - (H11)] + (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(57)
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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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
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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 = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	219.5	193.41	202.98	181.76	177.98	158.83	152.35	167.44	167.22	188.49	199.55	214.15	(62)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

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

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

Output from water heater

(64)m=	219.5	193.41	202.98	181.76	177.98	158.83	152.35	167.44	167.22	188.49	199.55	214.15	
Output from water heater (annual) =													2223.65 (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=	96.38	85.44	90.89	83.08	82.58	75.45	74.05	79.07	78.24	86.07	88.99	94.6	(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 Tables 4 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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DER WorkSheet: New dwelling design stage



(66)m=	146.69	146.69	146.69	146.69	146.69	146.69	146.69	146.69	146.69	146.69	146.69	146.69	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	28.87	25.64	20.85	15.79	11.8	9.96	10.76	13.99	18.78	23.85	27.83	29.67	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	320.24	323.56	315.19	297.36	274.86	253.71	239.58	236.25	244.63	262.46	284.96	306.11	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.67	37.67	37.67	37.67	37.67	37.67	37.67	37.67	37.67	37.67	37.67	37.67	(69)
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Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35	-117.35	(71)
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Water heating gains (Table 5)

(72)m=	129.54	127.14	122.16	115.39	110.99	104.8	99.53	106.28	108.67	115.68	123.6	127.15	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	548.66	546.35	528.21	498.54	467.65	438.47	419.88	426.53	442.09	471.99	506.4	532.94	(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)	
Northeast 0.9x	0.77	x	8.4	x	11.28	x	0.63	x	0.7	=	28.96	(75)
Northeast 0.9x	0.77	x	1.8	x	11.28	x	0.63	x	0.7	=	6.21	(75)
Northeast 0.9x	0.77	x	1.8	x	11.28	x	0.63	x	0.7	=	6.21	(75)
Northeast 0.9x	0.77	x	8.4	x	22.97	x	0.63	x	0.7	=	58.96	(75)
Northeast 0.9x	0.77	x	1.8	x	22.97	x	0.63	x	0.7	=	12.63	(75)
Northeast 0.9x	0.77	x	1.8	x	22.97	x	0.63	x	0.7	=	12.63	(75)
Northeast 0.9x	0.77	x	8.4	x	41.38	x	0.63	x	0.7	=	106.23	(75)
Northeast 0.9x	0.77	x	1.8	x	41.38	x	0.63	x	0.7	=	22.76	(75)
Northeast 0.9x	0.77	x	1.8	x	41.38	x	0.63	x	0.7	=	22.76	(75)
Northeast 0.9x	0.77	x	8.4	x	67.96	x	0.63	x	0.7	=	174.45	(75)
Northeast 0.9x	0.77	x	1.8	x	67.96	x	0.63	x	0.7	=	37.38	(75)
Northeast 0.9x	0.77	x	1.8	x	67.96	x	0.63	x	0.7	=	37.38	(75)
Northeast 0.9x	0.77	x	8.4	x	91.35	x	0.63	x	0.7	=	234.5	(75)
Northeast 0.9x	0.77	x	1.8	x	91.35	x	0.63	x	0.7	=	50.25	(75)
Northeast 0.9x	0.77	x	1.8	x	91.35	x	0.63	x	0.7	=	50.25	(75)
Northeast 0.9x	0.77	x	8.4	x	97.38	x	0.63	x	0.7	=	250	(75)
Northeast 0.9x	0.77	x	1.8	x	97.38	x	0.63	x	0.7	=	53.57	(75)
Northeast 0.9x	0.77	x	1.8	x	97.38	x	0.63	x	0.7	=	53.57	(75)
Northeast 0.9x	0.77	x	8.4	x	91.1	x	0.63	x	0.7	=	233.87	(75)
Northeast 0.9x	0.77	x	1.8	x	91.1	x	0.63	x	0.7	=	50.12	(75)
Northeast 0.9x	0.77	x	1.8	x	91.1	x	0.63	x	0.7	=	50.12	(75)

DER WorkSheet: New dwelling design stage



Northeast 0.9x	0.77	x	8.4	x	72.63	x	0.63	x	0.7	=	186.44	(75)
Northeast 0.9x	0.77	x	1.8	x	72.63	x	0.63	x	0.7	=	39.95	(75)
Northeast 0.9x	0.77	x	1.8	x	72.63	x	0.63	x	0.7	=	39.95	(75)
Northeast 0.9x	0.77	x	8.4	x	50.42	x	0.63	x	0.7	=	129.44	(75)
Northeast 0.9x	0.77	x	1.8	x	50.42	x	0.63	x	0.7	=	27.74	(75)
Northeast 0.9x	0.77	x	1.8	x	50.42	x	0.63	x	0.7	=	27.74	(75)
Northeast 0.9x	0.77	x	8.4	x	28.07	x	0.63	x	0.7	=	72.05	(75)
Northeast 0.9x	0.77	x	1.8	x	28.07	x	0.63	x	0.7	=	15.44	(75)
Northeast 0.9x	0.77	x	1.8	x	28.07	x	0.63	x	0.7	=	15.44	(75)
Northeast 0.9x	0.77	x	8.4	x	14.2	x	0.63	x	0.7	=	36.45	(75)
Northeast 0.9x	0.77	x	1.8	x	14.2	x	0.63	x	0.7	=	7.81	(75)
Northeast 0.9x	0.77	x	1.8	x	14.2	x	0.63	x	0.7	=	7.81	(75)
Northeast 0.9x	0.77	x	8.4	x	9.21	x	0.63	x	0.7	=	23.65	(75)
Northeast 0.9x	0.77	x	1.8	x	9.21	x	0.63	x	0.7	=	5.07	(75)
Northeast 0.9x	0.77	x	1.8	x	9.21	x	0.63	x	0.7	=	5.07	(75)
Southeast 0.9x	0.77	x	1.44	x	36.79	x	0.63	x	0.7	=	32.38	(77)
Southeast 0.9x	0.77	x	1.44	x	62.67	x	0.63	x	0.7	=	55.16	(77)
Southeast 0.9x	0.77	x	1.44	x	85.75	x	0.63	x	0.7	=	75.48	(77)
Southeast 0.9x	0.77	x	1.44	x	106.25	x	0.63	x	0.7	=	93.52	(77)
Southeast 0.9x	0.77	x	1.44	x	119.01	x	0.63	x	0.7	=	104.75	(77)
Southeast 0.9x	0.77	x	1.44	x	118.15	x	0.63	x	0.7	=	103.99	(77)
Southeast 0.9x	0.77	x	1.44	x	113.91	x	0.63	x	0.7	=	100.26	(77)
Southeast 0.9x	0.77	x	1.44	x	104.39	x	0.63	x	0.7	=	91.88	(77)
Southeast 0.9x	0.77	x	1.44	x	92.85	x	0.63	x	0.7	=	81.73	(77)
Southeast 0.9x	0.77	x	1.44	x	69.27	x	0.63	x	0.7	=	60.97	(77)
Southeast 0.9x	0.77	x	1.44	x	44.07	x	0.63	x	0.7	=	38.79	(77)
Southeast 0.9x	0.77	x	1.44	x	31.49	x	0.63	x	0.7	=	27.71	(77)
Southwest 0.9x	0.77	x	4.8	x	36.79		0.63	x	0.7	=	53.97	(79)
Southwest 0.9x	0.77	x	0.72	x	36.79		0.63	x	0.7	=	8.1	(79)
Southwest 0.9x	0.77	x	1.44	x	36.79		0.63	x	0.7	=	16.19	(79)
Southwest 0.9x	0.77	x	1.44	x	36.79		0.63	x	0.7	=	16.19	(79)
Southwest 0.9x	0.77	x	4.8	x	62.67		0.63	x	0.7	=	91.94	(79)
Southwest 0.9x	0.77	x	0.72	x	62.67		0.63	x	0.7	=	13.79	(79)
Southwest 0.9x	0.77	x	1.44	x	62.67		0.63	x	0.7	=	27.58	(79)
Southwest 0.9x	0.77	x	1.44	x	62.67		0.63	x	0.7	=	27.58	(79)
Southwest 0.9x	0.77	x	4.8	x	85.75		0.63	x	0.7	=	125.79	(79)
Southwest 0.9x	0.77	x	0.72	x	85.75		0.63	x	0.7	=	18.87	(79)
Southwest 0.9x	0.77	x	1.44	x	85.75		0.63	x	0.7	=	37.74	(79)
Southwest 0.9x	0.77	x	1.44	x	85.75		0.63	x	0.7	=	37.74	(79)
Southwest 0.9x	0.77	x	4.8	x	106.25		0.63	x	0.7	=	155.87	(79)
Southwest 0.9x	0.77	x	0.72	x	106.25		0.63	x	0.7	=	23.38	(79)

DER WorkSheet: New dwelling design stage



Southwest0.9x	0.77	x	1.44	x	106.25	0.63	x	0.7	=	46.76	(79)
Southwest0.9x	0.77	x	1.44	x	106.25	0.63	x	0.7	=	46.76	(79)
Southwest0.9x	0.77	x	4.8	x	119.01	0.63	x	0.7	=	174.58	(79)
Southwest0.9x	0.77	x	0.72	x	119.01	0.63	x	0.7	=	26.19	(79)
Southwest0.9x	0.77	x	1.44	x	119.01	0.63	x	0.7	=	52.37	(79)
Southwest0.9x	0.77	x	1.44	x	119.01	0.63	x	0.7	=	52.37	(79)
Southwest0.9x	0.77	x	4.8	x	118.15	0.63	x	0.7	=	173.32	(79)
Southwest0.9x	0.77	x	0.72	x	118.15	0.63	x	0.7	=	26	(79)
Southwest0.9x	0.77	x	1.44	x	118.15	0.63	x	0.7	=	52	(79)
Southwest0.9x	0.77	x	1.44	x	118.15	0.63	x	0.7	=	52	(79)
Southwest0.9x	0.77	x	4.8	x	113.91	0.63	x	0.7	=	167.1	(79)
Southwest0.9x	0.77	x	0.72	x	113.91	0.63	x	0.7	=	25.06	(79)
Southwest0.9x	0.77	x	1.44	x	113.91	0.63	x	0.7	=	50.13	(79)
Southwest0.9x	0.77	x	1.44	x	113.91	0.63	x	0.7	=	50.13	(79)
Southwest0.9x	0.77	x	4.8	x	104.39	0.63	x	0.7	=	153.13	(79)
Southwest0.9x	0.77	x	0.72	x	104.39	0.63	x	0.7	=	22.97	(79)
Southwest0.9x	0.77	x	1.44	x	104.39	0.63	x	0.7	=	45.94	(79)
Southwest0.9x	0.77	x	1.44	x	104.39	0.63	x	0.7	=	45.94	(79)
Southwest0.9x	0.77	x	4.8	x	92.85	0.63	x	0.7	=	136.21	(79)
Southwest0.9x	0.77	x	0.72	x	92.85	0.63	x	0.7	=	20.43	(79)
Southwest0.9x	0.77	x	1.44	x	92.85	0.63	x	0.7	=	40.86	(79)
Southwest0.9x	0.77	x	1.44	x	92.85	0.63	x	0.7	=	40.86	(79)
Southwest0.9x	0.77	x	4.8	x	69.27	0.63	x	0.7	=	101.61	(79)
Southwest0.9x	0.77	x	0.72	x	69.27	0.63	x	0.7	=	15.24	(79)
Southwest0.9x	0.77	x	1.44	x	69.27	0.63	x	0.7	=	30.48	(79)
Southwest0.9x	0.77	x	1.44	x	69.27	0.63	x	0.7	=	30.48	(79)
Southwest0.9x	0.77	x	4.8	x	44.07	0.63	x	0.7	=	64.65	(79)
Southwest0.9x	0.77	x	0.72	x	44.07	0.63	x	0.7	=	9.7	(79)
Southwest0.9x	0.77	x	1.44	x	44.07	0.63	x	0.7	=	19.39	(79)
Southwest0.9x	0.77	x	1.44	x	44.07	0.63	x	0.7	=	19.39	(79)
Southwest0.9x	0.77	x	4.8	x	31.49	0.63	x	0.7	=	46.19	(79)
Southwest0.9x	0.77	x	0.72	x	31.49	0.63	x	0.7	=	6.93	(79)
Southwest0.9x	0.77	x	1.44	x	31.49	0.63	x	0.7	=	13.86	(79)
Southwest0.9x	0.77	x	1.44	x	31.49	0.63	x	0.7	=	13.86	(79)
Northwest0.9x	0.77	x	1.05	x	11.28	0.63	x	0.7	=	3.62	(81)
Northwest0.9x	0.77	x	1.56	x	11.28	0.63	x	0.7	=	5.38	(81)
Northwest0.9x	0.77	x	1.05	x	22.97	0.63	x	0.7	=	7.37	(81)
Northwest0.9x	0.77	x	1.56	x	22.97	0.63	x	0.7	=	10.95	(81)
Northwest0.9x	0.77	x	1.05	x	41.38	0.63	x	0.7	=	13.28	(81)
Northwest0.9x	0.77	x	1.56	x	41.38	0.63	x	0.7	=	19.73	(81)
Northwest0.9x	0.77	x	1.05	x	67.96	0.63	x	0.7	=	21.81	(81)

DER WorkSheet: New dwelling design stage



Northwest 0.9x	0.77	x	1.56	x	67.96	x	0.63	x	0.7	=	32.4	(81)
Northwest 0.9x	0.77	x	1.05	x	91.35	x	0.63	x	0.7	=	29.31	(81)
Northwest 0.9x	0.77	x	1.56	x	91.35	x	0.63	x	0.7	=	43.55	(81)
Northwest 0.9x	0.77	x	1.05	x	97.38	x	0.63	x	0.7	=	31.25	(81)
Northwest 0.9x	0.77	x	1.56	x	97.38	x	0.63	x	0.7	=	46.43	(81)
Northwest 0.9x	0.77	x	1.05	x	91.1	x	0.63	x	0.7	=	29.23	(81)
Northwest 0.9x	0.77	x	1.56	x	91.1	x	0.63	x	0.7	=	43.43	(81)
Northwest 0.9x	0.77	x	1.05	x	72.63	x	0.63	x	0.7	=	23.31	(81)
Northwest 0.9x	0.77	x	1.56	x	72.63	x	0.63	x	0.7	=	34.63	(81)
Northwest 0.9x	0.77	x	1.05	x	50.42	x	0.63	x	0.7	=	16.18	(81)
Northwest 0.9x	0.77	x	1.56	x	50.42	x	0.63	x	0.7	=	24.04	(81)
Northwest 0.9x	0.77	x	1.05	x	28.07	x	0.63	x	0.7	=	9.01	(81)
Northwest 0.9x	0.77	x	1.56	x	28.07	x	0.63	x	0.7	=	13.38	(81)
Northwest 0.9x	0.77	x	1.05	x	14.2	x	0.63	x	0.7	=	4.56	(81)
Northwest 0.9x	0.77	x	1.56	x	14.2	x	0.63	x	0.7	=	6.77	(81)
Northwest 0.9x	0.77	x	1.05	x	9.21	x	0.63	x	0.7	=	2.96	(81)
Northwest 0.9x	0.77	x	1.56	x	9.21	x	0.63	x	0.7	=	4.39	(81)
Rooflights 0.9x	1	x	0.43	x	16.37	x	0.63	x	0.7	=	2.79	(82)
Rooflights 0.9x	1	x	1.31	x	39.98	x	0.63	x	0.7	=	20.84	(82)
Rooflights 0.9x	1	x	0.76	x	39.98	x	0.63	x	0.7	=	12.13	(82)
Rooflights 0.9x	1	x	0.43	x	33.68	x	0.63	x	0.7	=	5.74	(82)
Rooflights 0.9x	1	x	1.31	x	73.48	x	0.63	x	0.7	=	38.3	(82)
Rooflights 0.9x	1	x	0.76	x	73.48	x	0.63	x	0.7	=	22.29	(82)
Rooflights 0.9x	1	x	0.43	x	62.13	x	0.63	x	0.7	=	10.58	(82)
Rooflights 0.9x	1	x	1.31	x	112.11	x	0.63	x	0.7	=	58.43	(82)
Rooflights 0.9x	1	x	0.76	x	112.11	x	0.63	x	0.7	=	34.01	(82)
Rooflights 0.9x	1	x	0.43	x	104.87	x	0.63	x	0.7	=	17.86	(82)
Rooflights 0.9x	1	x	1.31	x	153.81	x	0.63	x	0.7	=	80.17	(82)
Rooflights 0.9x	1	x	0.76	x	153.81	x	0.63	x	0.7	=	46.66	(82)
Rooflights 0.9x	1	x	0.43	x	143.66	x	0.63	x	0.7	=	24.46	(82)
Rooflights 0.9x	1	x	1.31	x	182.63	x	0.63	x	0.7	=	95.19	(82)
Rooflights 0.9x	1	x	0.76	x	182.63	x	0.63	x	0.7	=	55.41	(82)
Rooflights 0.9x	1	x	0.43	x	154.33	x	0.63	x	0.7	=	26.28	(82)
Rooflights 0.9x	1	x	1.31	x	184.99	x	0.63	x	0.7	=	96.42	(82)
Rooflights 0.9x	1	x	0.76	x	184.99	x	0.63	x	0.7	=	56.13	(82)
Rooflights 0.9x	1	x	0.43	x	143.9	x	0.63	x	0.7	=	24.5	(82)
Rooflights 0.9x	1	x	1.31	x	176.88	x	0.63	x	0.7	=	92.19	(82)
Rooflights 0.9x	1	x	0.76	x	176.88	x	0.63	x	0.7	=	53.67	(82)
Rooflights 0.9x	1	x	0.43	x	113.05	x	0.63	x	0.7	=	19.25	(82)
Rooflights 0.9x	1	x	1.31	x	155.4	x	0.63	x	0.7	=	80.99	(82)
Rooflights 0.9x	1	x	0.76	x	155.4	x	0.63	x	0.7	=	47.15	(82)

DER WorkSheet: New dwelling design stage



Rooflights 0.9x	1	x	0.43	x	76.56	x	0.63	x	0.7	=	13.04	(82)
Rooflights 0.9x	1	x	1.31	x	126.86	x	0.63	x	0.7	=	66.12	(82)
Rooflights 0.9x	1	x	0.76	x	126.86	x	0.63	x	0.7	=	38.49	(82)
Rooflights 0.9x	1	x	0.43	x	41.49	x	0.63	x	0.7	=	7.07	(82)
Rooflights 0.9x	1	x	1.31	x	84.6	x	0.63	x	0.7	=	44.09	(82)
Rooflights 0.9x	1	x	0.76	x	84.6	x	0.63	x	0.7	=	25.67	(82)
Rooflights 0.9x	1	x	0.43	x	20.65	x	0.63	x	0.7	=	3.52	(82)
Rooflights 0.9x	1	x	1.31	x	48.93	x	0.63	x	0.7	=	25.5	(82)
Rooflights 0.9x	1	x	0.76	x	48.93	x	0.63	x	0.7	=	14.84	(82)
Rooflights 0.9x	1	x	0.43	x	13.34	x	0.63	x	0.7	=	2.27	(82)
Rooflights 0.9x	1	x	1.31	x	33.5	x	0.63	x	0.7	=	17.46	(82)
Rooflights 0.9x	1	x	0.76	x	33.5	x	0.63	x	0.7	=	10.16	(82)

Solar gains in watts, calculated for each month

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

(83)m=	212.97	384.93	583.4	814.4	993.19	1020.95	969.81	831.53	662.86	440.93	259.18	179.58	(83)
--------	--------	--------	-------	-------	--------	---------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	761.63	931.28	1111.61	1312.94	1460.84	1459.42	1389.69	1258.06	1104.95	912.92	765.58	712.52	(84)
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7. Mean internal temperature in living area (85) to (90)

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=	0.98	0.96	0.93	0.87	0.76	0.61	0.48	0.54	0.75	0.91	0.96	0.98	(86)

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

(87)m=	18.89	19.13	19.52	20.03	20.44	20.73	20.83	20.81	20.58	20.02	19.38	18.88	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.91	19.92	19.92	19.95	19.95	19.98	19.98	19.98	19.97	19.95	19.94	19.93	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.97	0.96	0.92	0.84	0.72	0.54	0.39	0.44	0.69	0.89	0.96	0.98	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.08	17.42	17.98	18.72	19.29	19.67	19.78	19.77	19.5	18.74	17.81	17.06	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.21

(91)

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

(92)m=	17.45	17.78	18.3	18.99	19.53	19.89	20	19.99	19.72	19	18.14	17.44	(92)
--------	-------	-------	------	-------	-------	-------	----	-------	-------	----	-------	-------	------

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

(93)m=	17.3	17.63	18.15	18.84	19.38	19.74	19.85	19.84	19.57	18.85	17.99	17.29	(93)
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8. Space heating calculation

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=	0.96	0.94	0.89	0.81	0.69	0.52	0.37	0.43	0.66	0.86	0.94	0.97	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	731.47	872.77	994.84	1067.71	1005.94	763.66	520.09	535.6	730.81	785	720.55	688.26	(95)
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DER WorkSheet: New dwelling design stage



Monthly average external temperature from Table 8

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

(97)m=	2356.97	2295.18	2089.98	1737.23	1334.93	869.21	549.87	577.89	935.77	1434.53	1912.53	2324.01	(97)
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Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	1209.37	955.86	814.79	482.06	244.77	0	0	0	0	483.25	858.23	1217	
Total per year (kWh/year) = $\text{Sum}(98)_{1..12} =$												6265.31	(98)

Space heating requirement in kWh/m²/year

41.84	(99)
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Energy requirements for individual heating systems including solar (EHP)

Space heating:

Fraction of space heat from secondary/supplementary system

0.1	(201)
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Fraction of space heat from main system(s) (202) = $1 - (201) =$

0.9	(202)
-----	-------

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

0.9	(204)
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Efficiency of main space heating system 1

90.1	(206)
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Efficiency of secondary/supplementary heating system, %

65	(208)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

1209.37	955.86	814.79	482.06	244.77	0	0	0	0	483.25	858.23	1217
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(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

1208.02	954.8	813.88	481.52	244.5	0	0	0	0	482.71	857.27	1215.65
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Total (kWh/year) = $\text{Sum}(211)_{1..12} =$ 6258.36 (211)

Space heating fuel (secondary), kWh/month

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

(215)m=	186.06	147.05	125.35	74.16	37.66	0	0	0	0	74.35	132.03	187.23	
Total (kWh/year) = $\text{Sum}(215)_{1..12} =$												963.89	(215)

Water heating

Output from water heater (calculated above)

219.5	193.41	202.98	181.76	177.98	158.83	152.35	167.44	167.22	188.49	199.55	214.15
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Efficiency of water heater

80	(216)
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(217)m= 88.23 88.06 87.7 86.86 85.29 80 80 80 80 86.79 87.82 88.28 (217)

Fuel for water heating, kWh/month

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

(219)m=	248.78	219.63	231.45	209.25	208.68	198.54	190.43	209.3	209.03	217.18	227.22	242.59	
Total = $\text{Sum}(219a)_{1..12} =$												2612.08	(219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

6258.36

Space heating fuel used, secondary

963.89

Water heating fuel used

2612.08

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

419.63	(230a)
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central heating pump:

30	(230c)
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ER WorkSheet: New dwelling design stage

Total electricity for the above, kWh/year	sum of (230a)...(230g) =	449.63	(231)
Electricity for lighting		509.81	(232)
Electricity generated by PVs		-1084.32	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		9709.45	(338)

2.2. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	::	1351.81 (261)
Space heating (secondary)	(215) x	0.019	::	18.31 (263)
Water heating	(219) x	0.216	::	564.21 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1934.33 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	::	233.36 (267)
Electricity for lighting	(232) x	0.519	::	264.59 (268)
Energy saving/generation technologies Item 1		0.519	::	-562.76 (269)
Total CO2, kg/year		sum of (265)...(271) =		1869.52 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		12.49 (273)
EI rating (section 14)				87 (274)