

Regulations Compliance Report

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51

Printed on 27 January 2022 at 12:34:25

Project Information:

Assessed By: Matthew Ray (STRO036484)**Building Type:** Detached Bungalow

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 48.04m²**Site Reference :** BE2664**Plot Reference:** BE2664 - Type 2 - ASHP + PV**Address :** Plots 4 - 16, Little Acres, New Barn, Longfield, DA3 7LA

Client Details:

Name: William Cook**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)

37.29 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

26.86 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

75.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

70.6 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.16 (max. 0.30)

0.16 (max. 0.70)

OK

Floor

0.18 (max. 0.25)

0.18 (max. 0.70)

OK

Roof

0.16 (max. 0.20)

0.16 (max. 0.35)

OK

Openings

1.40 (max. 2.00)

1.40 (max. 3.30)

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric

Air source heat pump in other cases

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.50 kWh/day

Permitted by DBSCG: 1.89 kWh/day

OK

Primary pipework insulated:

Yes

OK

6 Controls

Space heating controls

TTZC by plumbing and electrical services

OK

Hot water controls:

Cylinderstat

OK

Independent timer for DHW

OK

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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	3.64m²
Windows facing: South	2.85m²
Windows facing: South	1.89m²
Windows facing: South	5.64m²
Windows facing: West	2.67m²
Windows facing: North	0.42m²
Windows facing: North	0.73m²
Windows facing: North	1.24m²
Ventilation rate:	6.00

10 Key features

Photovoltaic array

DRAFT

Predicted Energy Assessment

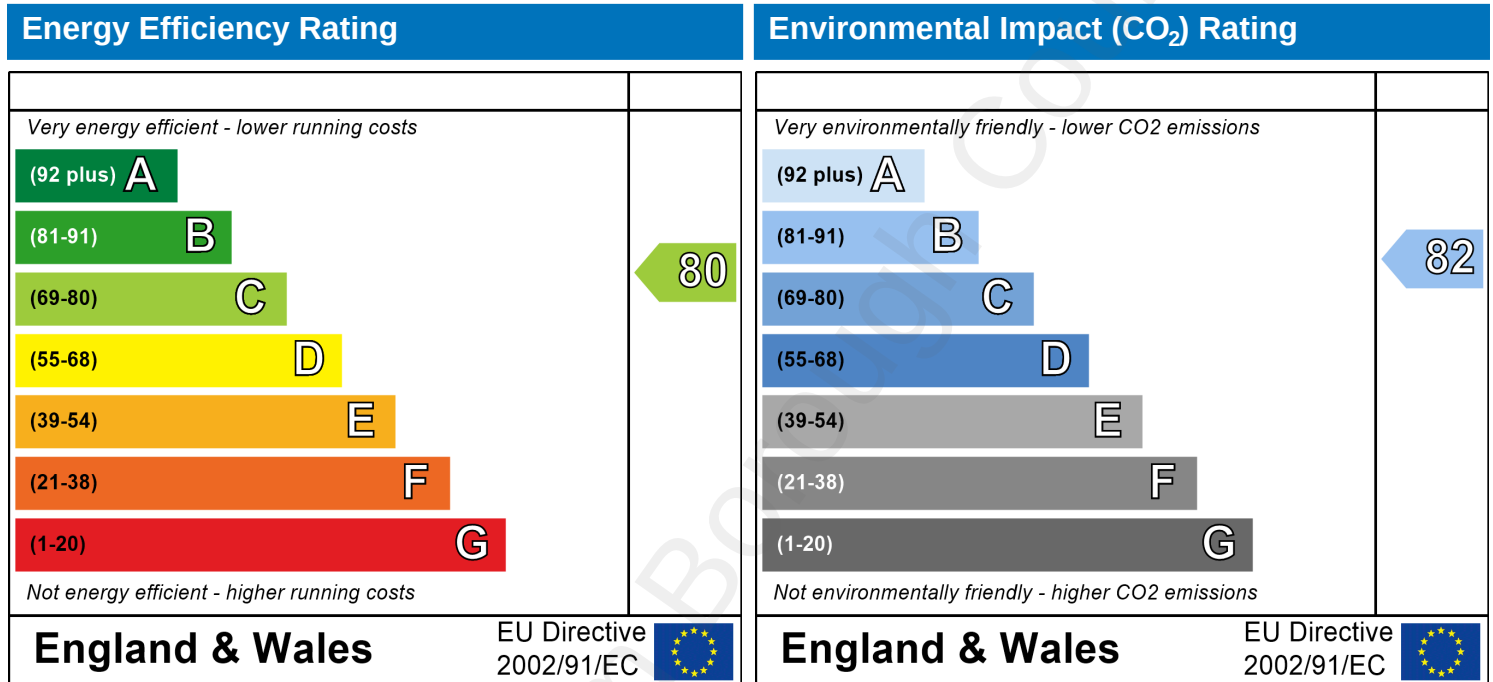
Plots 4 - 16
Little Acres
New Barn
Longfield
DA3 7LA

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

Detached Bungalow
24 January 2022
Matthew Ray
48.04 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 WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

User Details:

Assessor Name: Matthew Ray **Stroma Number:** STRO036484
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.51

Property Address: BE2664 - Type 2 - ASHP + PV

Address : Plots 4 - 16, Little Acres, New Barn, Longfield, DA3 7LA

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	48.04 (1a)	2.75 (2a)	132.11 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	48.04 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	132.11 (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) =	0.15 (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]×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <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>			0 (11)
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)			0.4 (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			2 (19)
Shelter factor	(20) = 1 - [0.075 × (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (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

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

0.44	0.43	0.42	0.38	0.37	0.32	0.32	0.32	0.34	0.37	0.38	0.4
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

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

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

0	(23c)
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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	(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	(24b)
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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	(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=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)
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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)
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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
Windows Type 1			3.64	$\times 1/[1/(1.4) + 0.04] =$	4.83		(27)
Windows Type 2			2.85	$\times 1/[1/(1.4) + 0.04] =$	3.78		(27)
Windows Type 3			1.89	$\times 1/[1/(1.4) + 0.04] =$	2.51		(27)
Windows Type 4			5.64	$\times 1/[1/(1.4) + 0.04] =$	7.48		(27)
Windows Type 5			2.67	$\times 1/[1/(1.4) + 0.04] =$	3.54		(27)
Windows Type 6			0.42	$\times 1/[1/(1.4) + 0.04] =$	0.56		(27)
Windows Type 7			0.73	$\times 1/[1/(1.4) + 0.04] =$	0.97		(27)
Windows Type 8			1.24	$\times 1/[1/(1.4) + 0.04] =$	1.64		(27)
Floor			48.04	x 0.18 =	8.647201		(28)
Walls	98.59	19.08	79.51	x 0.16 =	12.72		(29)
Roof	48.04	0	48.04	x 0.16 =	7.69		(30)
Total area of elements, m²			194.67				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 54.35 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 960.8 (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 15.12 (36)

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

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Total fabric heat loss (33) + (36) = 69.47 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.92	25.76	25.61	24.87	24.73	24.09	24.09	23.97	24.34	24.73	25.01	25.3	(38)

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

(39)m=	95.39	95.23	95.08	94.34	94.2	93.56	93.56	93.44	93.81	94.2	94.48	94.77	
Average = Sum(39) _{1...12} /12=												94.34	(39)

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

(40)m=	1.99	1.98	1.98	1.96	1.96	1.95	1.95	1.95	1.95	1.96	1.97	1.97	
Average = Sum(40) _{1...12} /12=												1.96	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.63 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 72.97 (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=	80.27	77.35	74.43	71.51	68.6	65.68	65.68	68.6	71.51	74.43	77.35	80.27	
Total = Sum(44) _{1...12} =												875.69	(44)

Energy content of hot water used - calculated monthly = 4.190 × Vd,m × nm × DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	119.04	104.11	107.44	93.66	89.87	77.55	71.87	82.47	83.45	97.25	106.16	115.28	
Total = Sum(45) _{1...12} =												1148.16	(45)

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

(46)m=	17.86	15.62	16.12	14.05	13.48	11.63	10.78	12.37	12.52	14.59	15.92	17.29	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.5 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) × (49) = 0.81 (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) × (51) × (52) × (53) = 0 (54)

Enter (50) or (54) in (55) 0.81 (55)

SAP WorkSheet: New dwelling design stage

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Water storage loss calculated for each month

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

(56)m=	25.11	22.68	25.11	24.3	25.11	24.3	25.11	25.11	24.3	25.11	24.3	25.11	(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=	25.11	22.68	25.11	24.3	25.11	24.3	25.11	25.11	24.3	25.11	24.3	25.11	(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=	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)
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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=	167.41	147.8	155.81	140.48	138.25	124.37	120.24	130.84	130.26	145.63	152.97	163.66	(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)
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Output from water heater

(64)m=	167.41	147.8	155.81	140.48	138.25	124.37	120.24	130.84	130.26	145.63	152.97	163.66	
Output from water heater (annual) _{1...12}												1717.71	(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=	78.28	69.57	74.42	68.59	68.58	63.24	62.59	66.12	65.2	71.04	72.75	77.03	(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=	97.95	97.95	97.95	97.95	97.95	97.95	97.95	97.95	97.95	97.95	97.95	97.95	(66)

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

(67)m=	31.68	28.14	22.88	17.32	12.95	10.93	11.81	15.36	20.61	26.17	30.54	32.56	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.16	214.36	208.81	197	182.09	168.08	158.72	156.52	162.06	173.88	188.78	202.8	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.43	46.43	46.43	46.43	46.43	46.43	46.43	46.43	46.43	46.43	46.43	46.43	(69)
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Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	(71)
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Water heating gains (Table 5)

(72)m=	105.21	103.53	100.03	95.27	92.18	87.83	84.13	88.87	90.55	95.48	101.04	103.53	(72)
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Total internal gains =

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

(73)m=	438.13	435.1	420.8	398.67	376.3	355.92	343.74	349.82	362.31	384.6	409.45	427.97	(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

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

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	0.42	x	10.63	x	0.63	x	0.7	=	1.36 (74)
North	0.9x	0.77	x	0.73	x	10.63	x	0.63	x	0.7	=	2.37 (74)
North	0.9x	0.77	x	1.24	x	10.63	x	0.63	x	0.7	=	4.03 (74)
North	0.9x	0.77	x	0.42	x	20.32	x	0.63	x	0.7	=	2.61 (74)
North	0.9x	0.77	x	0.73	x	20.32	x	0.63	x	0.7	=	4.53 (74)
North	0.9x	0.77	x	1.24	x	20.32	x	0.63	x	0.7	=	7.7 (74)
North	0.9x	0.77	x	0.42	x	34.53	x	0.63	x	0.7	=	4.43 (74)
North	0.9x	0.77	x	0.73	x	34.53	x	0.63	x	0.7	=	7.7 (74)
North	0.9x	0.77	x	1.24	x	34.53	x	0.63	x	0.7	=	13.09 (74)
North	0.9x	0.77	x	0.42	x	55.46	x	0.63	x	0.7	=	7.12 (74)
North	0.9x	0.77	x	0.73	x	55.46	x	0.63	x	0.7	=	12.37 (74)
North	0.9x	0.77	x	1.24	x	55.46	x	0.63	x	0.7	=	21.02 (74)
North	0.9x	0.77	x	0.42	x	74.72	x	0.63	x	0.7	=	9.59 (74)
North	0.9x	0.77	x	0.73	x	74.72	x	0.63	x	0.7	=	16.67 (74)
North	0.9x	0.77	x	1.24	x	74.72	x	0.63	x	0.7	=	28.31 (74)
North	0.9x	0.77	x	0.42	x	79.99	x	0.63	x	0.7	=	10.27 (74)
North	0.9x	0.77	x	0.73	x	79.99	x	0.63	x	0.7	=	17.84 (74)
North	0.9x	0.77	x	1.24	x	79.99	x	0.63	x	0.7	=	30.31 (74)
North	0.9x	0.77	x	0.42	x	74.68	x	0.63	x	0.7	=	9.59 (74)
North	0.9x	0.77	x	0.73	x	74.68	x	0.63	x	0.7	=	16.66 (74)
North	0.9x	0.77	x	1.24	x	74.68	x	0.63	x	0.7	=	28.3 (74)
North	0.9x	0.77	x	0.42	x	59.25	x	0.63	x	0.7	=	7.6 (74)
North	0.9x	0.77	x	0.73	x	59.25	x	0.63	x	0.7	=	13.22 (74)
North	0.9x	0.77	x	1.24	x	59.25	x	0.63	x	0.7	=	22.45 (74)
North	0.9x	0.77	x	0.42	x	41.52	x	0.63	x	0.7	=	5.33 (74)
North	0.9x	0.77	x	0.73	x	41.52	x	0.63	x	0.7	=	9.26 (74)
North	0.9x	0.77	x	1.24	x	41.52	x	0.63	x	0.7	=	15.73 (74)
North	0.9x	0.77	x	0.42	x	24.19	x	0.63	x	0.7	=	3.1 (74)
North	0.9x	0.77	x	0.73	x	24.19	x	0.63	x	0.7	=	5.4 (74)
North	0.9x	0.77	x	1.24	x	24.19	x	0.63	x	0.7	=	9.17 (74)
North	0.9x	0.77	x	0.42	x	13.12	x	0.63	x	0.7	=	1.68 (74)
North	0.9x	0.77	x	0.73	x	13.12	x	0.63	x	0.7	=	2.93 (74)
North	0.9x	0.77	x	1.24	x	13.12	x	0.63	x	0.7	=	4.97 (74)
North	0.9x	0.77	x	0.42	x	8.86	x	0.63	x	0.7	=	1.14 (74)
North	0.9x	0.77	x	0.73	x	8.86	x	0.63	x	0.7	=	1.98 (74)
North	0.9x	0.77	x	1.24	x	8.86	x	0.63	x	0.7	=	3.36 (74)
South	0.9x	0.77	x	3.64	x	46.75	x	0.63	x	0.7	=	52.01 (78)
South	0.9x	0.77	x	2.85	x	46.75	x	0.63	x	0.7	=	40.72 (78)
South	0.9x	0.77	x	1.89	x	46.75	x	0.63	x	0.7	=	27 (78)

SAP WorkSheet: New dwelling design stage*Results and inputs informed by developer declaration. Any deviation is certain to output different results.*

South	0.9x	0.77	x	5.64	x	46.75	x	0.63	x	0.7	=	80.58	(78)
South	0.9x	0.77	x	3.64	x	76.57	x	0.63	x	0.7	=	85.18	(78)
South	0.9x	0.77	x	2.85	x	76.57	x	0.63	x	0.7	=	66.69	(78)
South	0.9x	0.77	x	1.89	x	76.57	x	0.63	x	0.7	=	44.23	(78)
South	0.9x	0.77	x	5.64	x	76.57	x	0.63	x	0.7	=	131.98	(78)
South	0.9x	0.77	x	3.64	x	97.53	x	0.63	x	0.7	=	108.5	(78)
South	0.9x	0.77	x	2.85	x	97.53	x	0.63	x	0.7	=	84.95	(78)
South	0.9x	0.77	x	1.89	x	97.53	x	0.63	x	0.7	=	56.34	(78)
South	0.9x	0.77	x	5.64	x	97.53	x	0.63	x	0.7	=	168.11	(78)
South	0.9x	0.77	x	3.64	x	110.23	x	0.63	x	0.7	=	122.63	(78)
South	0.9x	0.77	x	2.85	x	110.23	x	0.63	x	0.7	=	96.01	(78)
South	0.9x	0.77	x	1.89	x	110.23	x	0.63	x	0.7	=	63.67	(78)
South	0.9x	0.77	x	5.64	x	110.23	x	0.63	x	0.7	=	190.01	(78)
South	0.9x	0.77	x	3.64	x	114.87	x	0.63	x	0.7	=	127.79	(78)
South	0.9x	0.77	x	2.85	x	114.87	x	0.63	x	0.7	=	100.05	(78)
South	0.9x	0.77	x	1.89	x	114.87	x	0.63	x	0.7	=	66.35	(78)
South	0.9x	0.77	x	5.64	x	114.87	x	0.63	x	0.7	=	198	(78)
South	0.9x	0.77	x	3.64	x	110.55	x	0.63	x	0.7	=	122.98	(78)
South	0.9x	0.77	x	2.85	x	110.55	x	0.63	x	0.7	=	96.29	(78)
South	0.9x	0.77	x	1.89	x	110.55	x	0.63	x	0.7	=	63.85	(78)
South	0.9x	0.77	x	5.64	x	110.55	x	0.63	x	0.7	=	190.55	(78)
South	0.9x	0.77	x	3.64	x	108.01	x	0.63	x	0.7	=	120.16	(78)
South	0.9x	0.77	x	2.85	x	108.01	x	0.63	x	0.7	=	94.08	(78)
South	0.9x	0.77	x	1.89	x	108.01	x	0.63	x	0.7	=	62.39	(78)
South	0.9x	0.77	x	5.64	x	108.01	x	0.63	x	0.7	=	186.18	(78)
South	0.9x	0.77	x	3.64	x	104.89	x	0.63	x	0.7	=	116.69	(78)
South	0.9x	0.77	x	2.85	x	104.89	x	0.63	x	0.7	=	91.36	(78)
South	0.9x	0.77	x	1.89	x	104.89	x	0.63	x	0.7	=	60.59	(78)
South	0.9x	0.77	x	5.64	x	104.89	x	0.63	x	0.7	=	180.8	(78)
South	0.9x	0.77	x	3.64	x	101.89	x	0.63	x	0.7	=	113.34	(78)
South	0.9x	0.77	x	2.85	x	101.89	x	0.63	x	0.7	=	88.74	(78)
South	0.9x	0.77	x	1.89	x	101.89	x	0.63	x	0.7	=	58.85	(78)
South	0.9x	0.77	x	5.64	x	101.89	x	0.63	x	0.7	=	175.62	(78)
South	0.9x	0.77	x	3.64	x	82.59	x	0.63	x	0.7	=	91.87	(78)
South	0.9x	0.77	x	2.85	x	82.59	x	0.63	x	0.7	=	71.93	(78)
South	0.9x	0.77	x	1.89	x	82.59	x	0.63	x	0.7	=	47.7	(78)
South	0.9x	0.77	x	5.64	x	82.59	x	0.63	x	0.7	=	142.35	(78)
South	0.9x	0.77	x	3.64	x	55.42	x	0.63	x	0.7	=	61.65	(78)
South	0.9x	0.77	x	2.85	x	55.42	x	0.63	x	0.7	=	48.27	(78)
South	0.9x	0.77	x	1.89	x	55.42	x	0.63	x	0.7	=	32.01	(78)
South	0.9x	0.77	x	5.64	x	55.42	x	0.63	x	0.7	=	95.52	(78)

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Results and inputs informed by developer declaration. Any deviation is certain to output different results.

South	0.9x	0.77	x	3.64	x	40.4	x	0.63	x	0.7	=	44.94	(78)
South	0.9x	0.77	x	2.85	x	40.4	x	0.63	x	0.7	=	35.19	(78)
South	0.9x	0.77	x	1.89	x	40.4	x	0.63	x	0.7	=	23.33	(78)
South	0.9x	0.77	x	5.64	x	40.4	x	0.63	x	0.7	=	69.63	(78)
West	0.9x	0.77	x	2.67	x	19.64	x	0.63	x	0.7	=	16.03	(80)
West	0.9x	0.77	x	2.67	x	38.42	x	0.63	x	0.7	=	31.35	(80)
West	0.9x	0.77	x	2.67	x	63.27	x	0.63	x	0.7	=	51.63	(80)
West	0.9x	0.77	x	2.67	x	92.28	x	0.63	x	0.7	=	75.3	(80)
West	0.9x	0.77	x	2.67	x	113.09	x	0.63	x	0.7	=	92.28	(80)
West	0.9x	0.77	x	2.67	x	115.77	x	0.63	x	0.7	=	94.47	(80)
West	0.9x	0.77	x	2.67	x	110.22	x	0.63	x	0.7	=	89.94	(80)
West	0.9x	0.77	x	2.67	x	94.68	x	0.63	x	0.7	=	77.25	(80)
West	0.9x	0.77	x	2.67	x	73.59	x	0.63	x	0.7	=	60.05	(80)
West	0.9x	0.77	x	2.67	x	45.59	x	0.63	x	0.7	=	37.2	(80)
West	0.9x	0.77	x	2.67	x	24.49	x	0.63	x	0.7	=	19.98	(80)
West	0.9x	0.77	x	2.67	x	16.15	x	0.63	x	0.7	=	13.18	(80)

Solar gains in watts, calculated for each month

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

(83)m=	224.11	374.26	494.75	588.13	639.04	626.55	607.28	569.97	526.92	408.72	267.01	192.75	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	662.24	809.37	915.56	986.81	1015.34	982.47	951.02	919.79	889.23	793.32	676.46	620.72	(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=	0.88	0.84	0.78	0.71	0.61	0.49	0.38	0.4	0.55	0.73	0.84	0.9	(86)

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

(87)m=	18.1	18.54	19.09	19.72	20.26	20.66	20.86	20.83	20.55	19.83	18.85	18.01	(87)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.34	19.35	19.35	19.36	19.36	19.37	19.37	19.37	19.37	19.36	19.36	19.35	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.87	0.81	0.75	0.66	0.54	0.4	0.26	0.28	0.46	0.67	0.82	0.88	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	15.76	16.36	17.12	17.96	18.65	19.13	19.3	19.29	19.01	18.14	16.82	15.64	(90)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.48

(91)

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

(92)m=	16.88	17.4	18.06	18.8	19.42	19.86	20.04	20.03	19.74	18.95	17.79	16.77	(92)
--------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	16.88	17.4	18.06	18.8	19.42	19.86	20.04	20.03	19.74	18.95	17.79	16.77	(93)
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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
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SAP WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Utilisation factor for gains, hm:

(94)m=	0.83	0.78	0.72	0.64	0.55	0.43	0.31	0.33	0.48	0.66	0.78	0.84	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	548.22	628.1	656.99	633.29	554.78	418.8	295.37	306.61	429.81	521.62	528.36	522.2	(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=	1200.06	1190.53	1099.12	933.58	727.04	492.06	322.28	338.74	529.37	786.5	1010.24	1191.17	(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=	484.97	377.95	328.94	216.21	128.16	0	0	0	0	197.07	346.96	497.72	(98)
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

2577.98

Space heating requirement in kWh/m²/year

53.66 (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

175.1 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

484.97	377.95	328.94	216.21	128.16	0	0	0	0	197.07	346.96	497.72
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(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

276.97	215.85	187.86	123.48	73.2	0	0	0	0	112.55	198.15	284.25
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Total (kWh/year) = Sum(211)_{1...5,10...12} =

1472.29 (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	(215)
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Total (kWh/year) = Sum(215)_{1...5,10...12} =

0 (215)

Water heating

Output from water heater (calculated above)

167.41	147.8	155.81	140.48	138.25	124.37	120.24	130.84	130.26	145.63	152.97	163.66
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Efficiency of water heater

175.1 (216)

(217)m=

175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	95.61	84.41	88.98	80.23	78.95	71.03	68.67	74.72	74.39	83.17	87.36	93.46	(219)
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Total = Sum(219a)_{1...12} =

980.99 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

1472.29

Water heating fuel used

980.99

Electricity for pumps, fans and electric keep-hot

SAP WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

central heating pump:		120	(230c)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	120	(231)
Electricity for lighting		223.8	(232)
Electricity generated by PVs		-431.81	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2365.27	(238)

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 = 194.2 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	13.19	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	13.19	x 0.01 = 129.39 (247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 = 15.83 (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 = 29.52 (250)
Additional standing charges (Table 12)			0 (251)
	one of (233) to (235) x	13.19	x 0.01 = -56.96 (252)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		311.98 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.41	(257)
SAP rating (Section 12)		80.35	(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	= 764.12 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.519	= 509.13 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1273.25 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 62.28 (267)
Electricity for lighting	(232) x	0.519	= 116.15 (268)
Energy saving/generation technologies Item 1		0.519	= -224.11 (269)
Total CO2, kg/year		sum of (265)...(271) =	1227.57 (272)
CO2 emissions per m²		(272) ÷ (4) =	25.55 (273)

SAP WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

El rating (section 14)

82

(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	4519.93	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	3011.63	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7531.56	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	368.4	(267)
Electricity for lighting	(232) x	0	=	687.06	(268)
Energy saving/generation technologies Item 1		3.07	=	-1325.66	(269)
'Total Primary Energy		sum of (265)...(271) =		7261.37	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		151.15	(273)

TREE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

User Details:

Assessor Name: Matthew Ray **Stroma Number:** STRO036484
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.51

Property Address: BE2664 - Type 2 - ASHP + PV

Address : Plots 4 - 16, Little Acres, New Barn, Longfield, DA3 7LA

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	48.04 (1a)	2.75 (2a)	132.11 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	48.04 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	132.11 (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) =	0.15 (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 <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>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.4 (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			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

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

TFEE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

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

0.44	0.43	0.42	0.38	0.37	0.32	0.32	0.32	0.34	0.37	0.38	0.4
------	------	------	------	------	------	------	------	------	------	------	-----

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 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
Windows Type 1			2.29	$\times 1/[1/(1.4) + 0.04] =$	3.04		(27)
Windows Type 2			1.79	$\times 1/[1/(1.4) + 0.04] =$	2.37		(27)
Windows Type 3			1.19	$\times 1/[1/(1.4) + 0.04] =$	1.58		(27)
Windows Type 4			3.55	$\times 1/[1/(1.4) + 0.04] =$	4.71		(27)
Windows Type 5			1.68	$\times 1/[1/(1.4) + 0.04] =$	2.23		(27)
Windows Type 6			0.26	$\times 1/[1/(1.4) + 0.04] =$	0.34		(27)
Windows Type 7			0.46	$\times 1/[1/(1.4) + 0.04] =$	0.61		(27)
Windows Type 8			0.78	$\times 1/[1/(1.4) + 0.04] =$	1.03		(27)
Floor			48.04	x 0.13 =	6.2452		(28)
Walls	98.59	12	86.59	x 0.18 =	15.59		(29)
Roof	48.04	0	48.04	x 0.13 =	6.25		(30)
Total area of elements, m²			194.67				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 43.99 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 960.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 12.22 (36)

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

TREE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Total fabric heat loss (33) + (36) = 56.21 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.92	25.76	25.61	24.87	24.73	24.09	24.09	23.97	24.34	24.73	25.01	25.3	(38)

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

(39)m=	82.13	81.97	81.81	81.07	80.94	80.29	80.29	80.17	80.54	80.94	81.21	81.51	
Average = Sum(39) _{1...12} /12=												81.07	(39)

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

(40)m=	1.71	1.71	1.7	1.69	1.68	1.67	1.67	1.67	1.68	1.68	1.69	1.7	
Average = Sum(40) _{1...12} /12=												1.69	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.63 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 72.97 (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=	80.27	77.35	74.43	71.51	68.6	65.68	65.68	68.6	71.51	74.43	77.35	80.27	
Total = Sum(44) _{1...12} =												875.69	(44)

Energy content of hot water used - calculated monthly = 4.190 × Vd,m × nm × DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	119.04	104.11	107.44	93.66	89.87	77.55	71.87	82.47	83.45	97.25	106.16	115.28	
Total = Sum(45) _{1...12} =												1148.16	(45)

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

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

TREE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Water storage loss calculated for each month

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

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (56)

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (57)

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

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

(61)m=

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=

101.18	88.5	91.32	79.62	76.39	65.92	61.09	70.1	70.93	82.67	90.24	97.99
--------	------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

 (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=

101.18	88.5	91.32	79.62	76.39	65.92	61.09	70.1	70.93	82.67	90.24	97.99
--------	------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

$$\text{Output from water heater (annual)}_{1..12}$$
 975.94 (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=

25.3	22.12	22.83	19.9	19.1	16.48	15.27	17.52	17.73	20.67	22.56	24.5
------	-------	-------	------	------	-------	-------	-------	-------	-------	-------	------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63

 (66)

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

(67)m=

12.67	11.26	9.15	6.93	5.18	4.37	4.73	6.14	8.24	10.47	12.22	13.02
-------	-------	------	------	------	------	------	------	------	-------	-------	-------

 (67)

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

(68)m=

142.15	143.62	139.9	131.99	122	112.61	106.34	104.87	108.58	116.5	126.49	135.87
--------	--------	-------	--------	-----	--------	--------	--------	--------	-------	--------	--------

 (68)

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

(69)m=

31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (71)

Water heating gains (Table 5)

(72)m=

34	32.92	30.69	27.64	25.67	22.89	20.53	23.55	24.63	27.78	31.33	32.93
----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)**Total internal gains =**

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

(73)m=

236.31	235.29	227.23	214.05	200.34	187.36	179.08	182.05	188.95	202.23	217.52	229.31
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)**6. Solar gains:**

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

TREE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

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	0.26	x	10.63	x	0.63	x	0.7	= 0.84 (74)
North	0.9x	0.77	x	0.46	x	10.63	x	0.63	x	0.7	= 1.49 (74)
North	0.9x	0.77	x	0.78	x	10.63	x	0.63	x	0.7	= 2.53 (74)
North	0.9x	0.77	x	0.26	x	20.32	x	0.63	x	0.7	= 1.61 (74)
North	0.9x	0.77	x	0.46	x	20.32	x	0.63	x	0.7	= 2.86 (74)
North	0.9x	0.77	x	0.78	x	20.32	x	0.63	x	0.7	= 4.84 (74)
North	0.9x	0.77	x	0.26	x	34.53	x	0.63	x	0.7	= 2.74 (74)
North	0.9x	0.77	x	0.46	x	34.53	x	0.63	x	0.7	= 4.85 (74)
North	0.9x	0.77	x	0.78	x	34.53	x	0.63	x	0.7	= 8.23 (74)
North	0.9x	0.77	x	0.26	x	55.46	x	0.63	x	0.7	= 4.41 (74)
North	0.9x	0.77	x	0.46	x	55.46	x	0.63	x	0.7	= 7.8 (74)
North	0.9x	0.77	x	0.78	x	55.46	x	0.63	x	0.7	= 13.22 (74)
North	0.9x	0.77	x	0.26	x	74.72	x	0.63	x	0.7	= 5.94 (74)
North	0.9x	0.77	x	0.46	x	74.72	x	0.63	x	0.7	= 10.5 (74)
North	0.9x	0.77	x	0.78	x	74.72	x	0.63	x	0.7	= 17.81 (74)
North	0.9x	0.77	x	0.26	x	79.99	x	0.63	x	0.7	= 6.36 (74)
North	0.9x	0.77	x	0.46	x	79.99	x	0.63	x	0.7	= 11.24 (74)
North	0.9x	0.77	x	0.78	x	79.99	x	0.63	x	0.7	= 19.07 (74)
North	0.9x	0.77	x	0.26	x	74.68	x	0.63	x	0.7	= 5.93 (74)
North	0.9x	0.77	x	0.46	x	74.68	x	0.63	x	0.7	= 10.5 (74)
North	0.9x	0.77	x	0.78	x	74.68	x	0.63	x	0.7	= 17.8 (74)
North	0.9x	0.77	x	0.26	x	59.25	x	0.63	x	0.7	= 4.71 (74)
North	0.9x	0.77	x	0.46	x	59.25	x	0.63	x	0.7	= 8.33 (74)
North	0.9x	0.77	x	0.78	x	59.25	x	0.63	x	0.7	= 14.12 (74)
North	0.9x	0.77	x	0.26	x	41.52	x	0.63	x	0.7	= 3.3 (74)
North	0.9x	0.77	x	0.46	x	41.52	x	0.63	x	0.7	= 5.84 (74)
North	0.9x	0.77	x	0.78	x	41.52	x	0.63	x	0.7	= 9.9 (74)
North	0.9x	0.77	x	0.26	x	24.19	x	0.63	x	0.7	= 1.92 (74)
North	0.9x	0.77	x	0.46	x	24.19	x	0.63	x	0.7	= 3.4 (74)
North	0.9x	0.77	x	0.78	x	24.19	x	0.63	x	0.7	= 5.77 (74)
North	0.9x	0.77	x	0.26	x	13.12	x	0.63	x	0.7	= 1.04 (74)
North	0.9x	0.77	x	0.46	x	13.12	x	0.63	x	0.7	= 1.84 (74)
North	0.9x	0.77	x	0.78	x	13.12	x	0.63	x	0.7	= 3.13 (74)
North	0.9x	0.77	x	0.26	x	8.86	x	0.63	x	0.7	= 0.7 (74)
North	0.9x	0.77	x	0.46	x	8.86	x	0.63	x	0.7	= 1.25 (74)
North	0.9x	0.77	x	0.78	x	8.86	x	0.63	x	0.7	= 2.11 (74)
South	0.9x	0.77	x	2.29	x	46.75	x	0.63	x	0.7	= 32.72 (78)
South	0.9x	0.77	x	1.79	x	46.75	x	0.63	x	0.7	= 25.58 (78)
South	0.9x	0.77	x	1.19	x	46.75	x	0.63	x	0.7	= 17 (78)

TREE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

South	0.9x	0.77	x	3.55	x	46.75	x	0.63	x	0.7	=	50.72	(78)
South	0.9x	0.77	x	2.29	x	76.57	x	0.63	x	0.7	=	53.59	(78)
South	0.9x	0.77	x	1.79	x	76.57	x	0.63	x	0.7	=	41.89	(78)
South	0.9x	0.77	x	1.19	x	76.57	x	0.63	x	0.7	=	27.85	(78)
South	0.9x	0.77	x	3.55	x	76.57	x	0.63	x	0.7	=	83.07	(78)
South	0.9x	0.77	x	2.29	x	97.53	x	0.63	x	0.7	=	68.26	(78)
South	0.9x	0.77	x	1.79	x	97.53	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	1.19	x	97.53	x	0.63	x	0.7	=	35.47	(78)
South	0.9x	0.77	x	3.55	x	97.53	x	0.63	x	0.7	=	105.82	(78)
South	0.9x	0.77	x	2.29	x	110.23	x	0.63	x	0.7	=	77.15	(78)
South	0.9x	0.77	x	1.79	x	110.23	x	0.63	x	0.7	=	60.3	(78)
South	0.9x	0.77	x	1.19	x	110.23	x	0.63	x	0.7	=	40.09	(78)
South	0.9x	0.77	x	3.55	x	110.23	x	0.63	x	0.7	=	119.6	(78)
South	0.9x	0.77	x	2.29	x	114.87	x	0.63	x	0.7	=	80.39	(78)
South	0.9x	0.77	x	1.79	x	114.87	x	0.63	x	0.7	=	62.84	(78)
South	0.9x	0.77	x	1.19	x	114.87	x	0.63	x	0.7	=	41.78	(78)
South	0.9x	0.77	x	3.55	x	114.87	x	0.63	x	0.7	=	124.63	(78)
South	0.9x	0.77	x	2.29	x	110.55	x	0.63	x	0.7	=	77.37	(78)
South	0.9x	0.77	x	1.79	x	110.55	x	0.63	x	0.7	=	60.47	(78)
South	0.9x	0.77	x	1.19	x	110.55	x	0.63	x	0.7	=	40.2	(78)
South	0.9x	0.77	x	3.55	x	110.55	x	0.63	x	0.7	=	119.94	(78)
South	0.9x	0.77	x	2.29	x	108.01	x	0.63	x	0.7	=	75.59	(78)
South	0.9x	0.77	x	1.79	x	108.01	x	0.63	x	0.7	=	59.09	(78)
South	0.9x	0.77	x	1.19	x	108.01	x	0.63	x	0.7	=	39.28	(78)
South	0.9x	0.77	x	3.55	x	108.01	x	0.63	x	0.7	=	117.18	(78)
South	0.9x	0.77	x	2.29	x	104.89	x	0.63	x	0.7	=	73.41	(78)
South	0.9x	0.77	x	1.79	x	104.89	x	0.63	x	0.7	=	57.38	(78)
South	0.9x	0.77	x	1.19	x	104.89	x	0.63	x	0.7	=	38.15	(78)
South	0.9x	0.77	x	3.55	x	104.89	x	0.63	x	0.7	=	113.8	(78)
South	0.9x	0.77	x	2.29	x	101.89	x	0.63	x	0.7	=	71.31	(78)
South	0.9x	0.77	x	1.79	x	101.89	x	0.63	x	0.7	=	55.74	(78)
South	0.9x	0.77	x	1.19	x	101.89	x	0.63	x	0.7	=	37.05	(78)
South	0.9x	0.77	x	3.55	x	101.89	x	0.63	x	0.7	=	110.54	(78)
South	0.9x	0.77	x	2.29	x	82.59	x	0.63	x	0.7	=	57.8	(78)
South	0.9x	0.77	x	1.79	x	82.59	x	0.63	x	0.7	=	45.18	(78)
South	0.9x	0.77	x	1.19	x	82.59	x	0.63	x	0.7	=	30.03	(78)
South	0.9x	0.77	x	3.55	x	82.59	x	0.63	x	0.7	=	89.6	(78)
South	0.9x	0.77	x	2.29	x	55.42	x	0.63	x	0.7	=	38.78	(78)
South	0.9x	0.77	x	1.79	x	55.42	x	0.63	x	0.7	=	30.32	(78)
South	0.9x	0.77	x	1.19	x	55.42	x	0.63	x	0.7	=	20.15	(78)
South	0.9x	0.77	x	3.55	x	55.42	x	0.63	x	0.7	=	60.12	(78)

TFEE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

South	0.9x	0.77	x	2.29	x	40.4	x	0.63	x	0.7	=	28.27	(78)
South	0.9x	0.77	x	1.79	x	40.4	x	0.63	x	0.7	=	22.1	(78)
South	0.9x	0.77	x	1.19	x	40.4	x	0.63	x	0.7	=	14.69	(78)
South	0.9x	0.77	x	3.55	x	40.4	x	0.63	x	0.7	=	43.83	(78)
West	0.9x	0.77	x	1.68	x	19.64	x	0.63	x	0.7	=	10.08	(80)
West	0.9x	0.77	x	1.68	x	38.42	x	0.63	x	0.7	=	19.73	(80)
West	0.9x	0.77	x	1.68	x	63.27	x	0.63	x	0.7	=	32.49	(80)
West	0.9x	0.77	x	1.68	x	92.28	x	0.63	x	0.7	=	47.38	(80)
West	0.9x	0.77	x	1.68	x	113.09	x	0.63	x	0.7	=	58.07	(80)
West	0.9x	0.77	x	1.68	x	115.77	x	0.63	x	0.7	=	59.44	(80)
West	0.9x	0.77	x	1.68	x	110.22	x	0.63	x	0.7	=	56.59	(80)
West	0.9x	0.77	x	1.68	x	94.68	x	0.63	x	0.7	=	48.61	(80)
West	0.9x	0.77	x	1.68	x	73.59	x	0.63	x	0.7	=	37.78	(80)
West	0.9x	0.77	x	1.68	x	45.59	x	0.63	x	0.7	=	23.41	(80)
West	0.9x	0.77	x	1.68	x	24.49	x	0.63	x	0.7	=	12.57	(80)
West	0.9x	0.77	x	1.68	x	16.15	x	0.63	x	0.7	=	8.29	(80)

Solar gains in watts, calculated for each month

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

(83)m=	140.98	235.43	311.22	369.94	401.95	394.09	381.97	358.51	331.45	257.11	167.96	121.25	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	377.29	470.72	538.45	584	602.29	581.45	561.05	540.56	520.39	459.34	385.49	350.56	(84)
--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.94	0.87	0.74	0.58	0.62	0.82	0.95	0.99	1	(86)

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

(87)m=	19.23	19.48	19.82	20.23	20.59	20.85	20.95	20.94	20.77	20.28	19.67	19.19	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.53	19.54	19.54	19.55	19.55	19.56	19.56	19.56	19.56	19.55	19.55	19.54	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.96	0.91	0.81	0.62	0.41	0.45	0.72	0.93	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.98	18.23	18.56	18.96	19.29	19.5	19.55	19.55	19.44	19.02	18.42	17.94	(90)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.48

(91)

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

(92)m=	18.58	18.83	19.16	19.56	19.91	20.14	20.22	20.21	20.07	19.62	19.02	18.53	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.58	18.83	19.16	19.56	19.91	20.14	20.22	20.21	20.07	19.62	19.02	18.53	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

TREE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.91	0.83	0.67	0.5	0.53	0.76	0.93	0.98	0.99	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

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

(95)m=	373.45	460.24	514.68	532.33	497.68	392.16	278.46	289.19	394.4	425.59	377.97	347.8	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1172.51	1141.43	1035.96	864.63	664.46	445.04	290.75	305.74	481.07	730	967.88	1168.33	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	-----	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	594.51	457.76	387.83	239.25	124.09	0	0	0	0	226.48	424.74	610.48	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 3065.13 (98)Space heating requirement in kWh/m²/year

63.8 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	754.76	594.17	609.33	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.78	0.86	0.84	0	0	0	0	(101)
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Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	591.24	509.39	510.86	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	741.61	716.6	693.55	0	0	0	0	(103)
---------	---	---	---	---	---	--------	-------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m

set (104)m to zero if (104)m < 3 x (98)m

(104)m=	0	0	0	0	0	108.26	154.16	135.92	0	0	0	0	(104)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Total = Sum(104) = 398.34 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	(106)
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Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m x (105) x (106)m

(107)m=	0	0	0	0	0	27.07	38.54	33.98	0	0	0	0	(107)
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	-------

Total = Sum(107) = 99.59 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 2.07 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 65.88 (109)

Target Fabric Energy Efficiency (TFEE) 75.76 (109)

DFEE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

User Details:

Assessor Name: Matthew Ray **Stroma Number:** STRO036484
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.51

Property Address: BE2664 - Type 2 - ASHP + PV

Address : Plots 4 - 16, Little Acres, New Barn, Longfield, DA3 7LA

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	48.04 (1a)	2.75 (2a)	132.11 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	48.04 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	132.11 (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) =	0.15 (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]×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <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>			0 (11)
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)			0.4 (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			2 (19)
Shelter factor	(20) = 1 - [0.075 × (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (20) =		0.34 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

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

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

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

0.44	0.43	0.42	0.38	0.37	0.32	0.32	0.32	0.34	0.37	0.38	0.4
------	------	------	------	------	------	------	------	------	------	------	-----

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 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
Windows Type 1			3.64	$\times 1/[1/(1.4) + 0.04] =$	4.83		(27)
Windows Type 2			2.85	$\times 1/[1/(1.4) + 0.04] =$	3.78		(27)
Windows Type 3			1.89	$\times 1/[1/(1.4) + 0.04] =$	2.51		(27)
Windows Type 4			5.64	$\times 1/[1/(1.4) + 0.04] =$	7.48		(27)
Windows Type 5			2.67	$\times 1/[1/(1.4) + 0.04] =$	3.54		(27)
Windows Type 6			0.42	$\times 1/[1/(1.4) + 0.04] =$	0.56		(27)
Windows Type 7			0.73	$\times 1/[1/(1.4) + 0.04] =$	0.97		(27)
Windows Type 8			1.24	$\times 1/[1/(1.4) + 0.04] =$	1.64		(27)
Floor			48.04	x 0.18 =	8.647201		(28)
Walls	98.59	19.08	79.51	x 0.16 =	12.72		(29)
Roof	48.04	0	48.04	x 0.16 =	7.69		(30)
Total area of elements, m²			194.67				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 54.35 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 960.8 (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 15.12 (36)

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

DFEE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Total fabric heat loss (33) + (36) = 69.47 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.92	25.76	25.61	24.87	24.73	24.09	24.09	23.97	24.34	24.73	25.01	25.3	(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=	95.39	95.23	95.08	94.34	94.2	93.56	93.56	93.44	93.81	94.2	94.48	94.77	
Average = Sum(39) _{1...12} /12=												94.34	(39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.99	1.98	1.98	1.96	1.96	1.95	1.95	1.95	1.95	1.96	1.97	1.97	
Average = Sum(40) _{1...12} /12=												1.96	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.63 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 72.97 (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=	80.27	77.35	74.43	71.51	68.6	65.68	65.68	68.6	71.51	74.43	77.35	80.27	
Total = Sum(44) _{1...12} =												875.69	(44)

Energy content of hot water used - calculated monthly = 4.190 × Vd,m × nm × DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	119.04	104.11	107.44	93.66	89.87	77.55	71.87	82.47	83.45	97.25	106.16	115.28	
Total = Sum(45) _{1...12} =												1148.16	(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=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

DFEE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Water storage loss calculated for each month

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

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (56)

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (57)

Primary circuit loss (annual) from Table 3

0 (58)

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

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

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

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

(61)m=

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=

101.18	88.5	91.32	79.62	76.39	65.92	61.09	70.1	70.93	82.67	90.24	97.99
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 (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=

101.18	88.5	91.32	79.62	76.39	65.92	61.09	70.1	70.93	82.67	90.24	97.99
--------	------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

 Output from water heater (annual)_{1...12} 975.94 (64)

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

(65)m=

25.3	22.12	22.83	19.9	19.1	16.48	15.27	17.52	17.73	20.67	22.56	24.5
------	-------	-------	------	------	-------	-------	-------	-------	-------	-------	------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63

 (66)

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

(67)m=

12.67	11.26	9.15	6.93	5.18	4.37	4.73	6.14	8.24	10.47	12.22	13.02
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 (67)

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

(68)m=

142.15	143.62	139.9	131.99	122	112.61	106.34	104.87	108.58	116.5	126.49	135.87
--------	--------	-------	--------	-----	--------	--------	--------	--------	-------	--------	--------

 (68)

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

(69)m=

31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (71)

Water heating gains (Table 5)

(72)m=

34	32.92	30.69	27.64	25.67	22.89	20.53	23.55	24.63	27.78	31.33	32.93
----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

Total internal gains =

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

(73)m=

236.31	235.29	227.23	214.05	200.34	187.36	179.08	182.05	188.95	202.23	217.52	229.31
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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.

DFEE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

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	0.42	x	10.63	x	0.63	x	0.7	= 1.36 (74)
North	0.9x	0.77	x	0.73	x	10.63	x	0.63	x	0.7	= 2.37 (74)
North	0.9x	0.77	x	1.24	x	10.63	x	0.63	x	0.7	= 4.03 (74)
North	0.9x	0.77	x	0.42	x	20.32	x	0.63	x	0.7	= 2.61 (74)
North	0.9x	0.77	x	0.73	x	20.32	x	0.63	x	0.7	= 4.53 (74)
North	0.9x	0.77	x	1.24	x	20.32	x	0.63	x	0.7	= 7.7 (74)
North	0.9x	0.77	x	0.42	x	34.53	x	0.63	x	0.7	= 4.43 (74)
North	0.9x	0.77	x	0.73	x	34.53	x	0.63	x	0.7	= 7.7 (74)
North	0.9x	0.77	x	1.24	x	34.53	x	0.63	x	0.7	= 13.09 (74)
North	0.9x	0.77	x	0.42	x	55.46	x	0.63	x	0.7	= 7.12 (74)
North	0.9x	0.77	x	0.73	x	55.46	x	0.63	x	0.7	= 12.37 (74)
North	0.9x	0.77	x	1.24	x	55.46	x	0.63	x	0.7	= 21.02 (74)
North	0.9x	0.77	x	0.42	x	74.72	x	0.63	x	0.7	= 9.59 (74)
North	0.9x	0.77	x	0.73	x	74.72	x	0.63	x	0.7	= 16.67 (74)
North	0.9x	0.77	x	1.24	x	74.72	x	0.63	x	0.7	= 28.31 (74)
North	0.9x	0.77	x	0.42	x	79.99	x	0.63	x	0.7	= 10.27 (74)
North	0.9x	0.77	x	0.73	x	79.99	x	0.63	x	0.7	= 17.84 (74)
North	0.9x	0.77	x	1.24	x	79.99	x	0.63	x	0.7	= 30.31 (74)
North	0.9x	0.77	x	0.42	x	74.68	x	0.63	x	0.7	= 9.59 (74)
North	0.9x	0.77	x	0.73	x	74.68	x	0.63	x	0.7	= 16.66 (74)
North	0.9x	0.77	x	1.24	x	74.68	x	0.63	x	0.7	= 28.3 (74)
North	0.9x	0.77	x	0.42	x	59.25	x	0.63	x	0.7	= 7.6 (74)
North	0.9x	0.77	x	0.73	x	59.25	x	0.63	x	0.7	= 13.22 (74)
North	0.9x	0.77	x	1.24	x	59.25	x	0.63	x	0.7	= 22.45 (74)
North	0.9x	0.77	x	0.42	x	41.52	x	0.63	x	0.7	= 5.33 (74)
North	0.9x	0.77	x	0.73	x	41.52	x	0.63	x	0.7	= 9.26 (74)
North	0.9x	0.77	x	1.24	x	41.52	x	0.63	x	0.7	= 15.73 (74)
North	0.9x	0.77	x	0.42	x	24.19	x	0.63	x	0.7	= 3.1 (74)
North	0.9x	0.77	x	0.73	x	24.19	x	0.63	x	0.7	= 5.4 (74)
North	0.9x	0.77	x	1.24	x	24.19	x	0.63	x	0.7	= 9.17 (74)
North	0.9x	0.77	x	0.42	x	13.12	x	0.63	x	0.7	= 1.68 (74)
North	0.9x	0.77	x	0.73	x	13.12	x	0.63	x	0.7	= 2.93 (74)
North	0.9x	0.77	x	1.24	x	13.12	x	0.63	x	0.7	= 4.97 (74)
North	0.9x	0.77	x	0.42	x	8.86	x	0.63	x	0.7	= 1.14 (74)
North	0.9x	0.77	x	0.73	x	8.86	x	0.63	x	0.7	= 1.98 (74)
North	0.9x	0.77	x	1.24	x	8.86	x	0.63	x	0.7	= 3.36 (74)
South	0.9x	0.77	x	3.64	x	46.75	x	0.63	x	0.7	= 52.01 (78)
South	0.9x	0.77	x	2.85	x	46.75	x	0.63	x	0.7	= 40.72 (78)
South	0.9x	0.77	x	1.89	x	46.75	x	0.63	x	0.7	= 27 (78)

DFEE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

South	0.9x	0.77	x	5.64	x	46.75	x	0.63	x	0.7	=	80.58	(78)
South	0.9x	0.77	x	3.64	x	76.57	x	0.63	x	0.7	=	85.18	(78)
South	0.9x	0.77	x	2.85	x	76.57	x	0.63	x	0.7	=	66.69	(78)
South	0.9x	0.77	x	1.89	x	76.57	x	0.63	x	0.7	=	44.23	(78)
South	0.9x	0.77	x	5.64	x	76.57	x	0.63	x	0.7	=	131.98	(78)
South	0.9x	0.77	x	3.64	x	97.53	x	0.63	x	0.7	=	108.5	(78)
South	0.9x	0.77	x	2.85	x	97.53	x	0.63	x	0.7	=	84.95	(78)
South	0.9x	0.77	x	1.89	x	97.53	x	0.63	x	0.7	=	56.34	(78)
South	0.9x	0.77	x	5.64	x	97.53	x	0.63	x	0.7	=	168.11	(78)
South	0.9x	0.77	x	3.64	x	110.23	x	0.63	x	0.7	=	122.63	(78)
South	0.9x	0.77	x	2.85	x	110.23	x	0.63	x	0.7	=	96.01	(78)
South	0.9x	0.77	x	1.89	x	110.23	x	0.63	x	0.7	=	63.67	(78)
South	0.9x	0.77	x	5.64	x	110.23	x	0.63	x	0.7	=	190.01	(78)
South	0.9x	0.77	x	3.64	x	114.87	x	0.63	x	0.7	=	127.79	(78)
South	0.9x	0.77	x	2.85	x	114.87	x	0.63	x	0.7	=	100.05	(78)
South	0.9x	0.77	x	1.89	x	114.87	x	0.63	x	0.7	=	66.35	(78)
South	0.9x	0.77	x	5.64	x	114.87	x	0.63	x	0.7	=	198	(78)
South	0.9x	0.77	x	3.64	x	110.55	x	0.63	x	0.7	=	122.98	(78)
South	0.9x	0.77	x	2.85	x	110.55	x	0.63	x	0.7	=	96.29	(78)
South	0.9x	0.77	x	1.89	x	110.55	x	0.63	x	0.7	=	63.85	(78)
South	0.9x	0.77	x	5.64	x	110.55	x	0.63	x	0.7	=	190.55	(78)
South	0.9x	0.77	x	3.64	x	108.01	x	0.63	x	0.7	=	120.16	(78)
South	0.9x	0.77	x	2.85	x	108.01	x	0.63	x	0.7	=	94.08	(78)
South	0.9x	0.77	x	1.89	x	108.01	x	0.63	x	0.7	=	62.39	(78)
South	0.9x	0.77	x	5.64	x	108.01	x	0.63	x	0.7	=	186.18	(78)
South	0.9x	0.77	x	3.64	x	104.89	x	0.63	x	0.7	=	116.69	(78)
South	0.9x	0.77	x	2.85	x	104.89	x	0.63	x	0.7	=	91.36	(78)
South	0.9x	0.77	x	1.89	x	104.89	x	0.63	x	0.7	=	60.59	(78)
South	0.9x	0.77	x	5.64	x	104.89	x	0.63	x	0.7	=	180.8	(78)
South	0.9x	0.77	x	3.64	x	101.89	x	0.63	x	0.7	=	113.34	(78)
South	0.9x	0.77	x	2.85	x	101.89	x	0.63	x	0.7	=	88.74	(78)
South	0.9x	0.77	x	1.89	x	101.89	x	0.63	x	0.7	=	58.85	(78)
South	0.9x	0.77	x	5.64	x	101.89	x	0.63	x	0.7	=	175.62	(78)
South	0.9x	0.77	x	3.64	x	82.59	x	0.63	x	0.7	=	91.87	(78)
South	0.9x	0.77	x	2.85	x	82.59	x	0.63	x	0.7	=	71.93	(78)
South	0.9x	0.77	x	1.89	x	82.59	x	0.63	x	0.7	=	47.7	(78)
South	0.9x	0.77	x	5.64	x	82.59	x	0.63	x	0.7	=	142.35	(78)
South	0.9x	0.77	x	3.64	x	55.42	x	0.63	x	0.7	=	61.65	(78)
South	0.9x	0.77	x	2.85	x	55.42	x	0.63	x	0.7	=	48.27	(78)
South	0.9x	0.77	x	1.89	x	55.42	x	0.63	x	0.7	=	32.01	(78)
South	0.9x	0.77	x	5.64	x	55.42	x	0.63	x	0.7	=	95.52	(78)

DFEE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

South	0.9x	0.77	x	3.64	x	40.4	x	0.63	x	0.7	=	44.94	(78)
South	0.9x	0.77	x	2.85	x	40.4	x	0.63	x	0.7	=	35.19	(78)
South	0.9x	0.77	x	1.89	x	40.4	x	0.63	x	0.7	=	23.33	(78)
South	0.9x	0.77	x	5.64	x	40.4	x	0.63	x	0.7	=	69.63	(78)
West	0.9x	0.77	x	2.67	x	19.64	x	0.63	x	0.7	=	16.03	(80)
West	0.9x	0.77	x	2.67	x	38.42	x	0.63	x	0.7	=	31.35	(80)
West	0.9x	0.77	x	2.67	x	63.27	x	0.63	x	0.7	=	51.63	(80)
West	0.9x	0.77	x	2.67	x	92.28	x	0.63	x	0.7	=	75.3	(80)
West	0.9x	0.77	x	2.67	x	113.09	x	0.63	x	0.7	=	92.28	(80)
West	0.9x	0.77	x	2.67	x	115.77	x	0.63	x	0.7	=	94.47	(80)
West	0.9x	0.77	x	2.67	x	110.22	x	0.63	x	0.7	=	89.94	(80)
West	0.9x	0.77	x	2.67	x	94.68	x	0.63	x	0.7	=	77.25	(80)
West	0.9x	0.77	x	2.67	x	73.59	x	0.63	x	0.7	=	60.05	(80)
West	0.9x	0.77	x	2.67	x	45.59	x	0.63	x	0.7	=	37.2	(80)
West	0.9x	0.77	x	2.67	x	24.49	x	0.63	x	0.7	=	19.98	(80)
West	0.9x	0.77	x	2.67	x	16.15	x	0.63	x	0.7	=	13.18	(80)

Solar gains in watts, calculated for each month

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

(83)m=	224.11	374.26	494.75	588.13	639.04	626.55	607.28	569.97	526.92	408.72	267.01	192.75	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	460.42	609.55	721.99	802.19	839.38	813.92	786.36	752.02	715.87	610.95	484.53	422.06	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.93	0.89	0.84	0.77	0.67	0.56	0.44	0.47	0.63	0.8	0.9	0.94	(86)

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

(87)m=	17.65	18.15	18.77	19.48	20.1	20.58	20.81	20.78	20.42	19.58	18.47	17.55	(87)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.34	19.35	19.35	19.36	19.36	19.37	19.37	19.37	19.37	19.36	19.36	19.35	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.92	0.87	0.81	0.73	0.61	0.46	0.3	0.33	0.53	0.75	0.88	0.93	(89)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

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

(90)m=	16.44	16.92	17.52	18.19	18.75	19.15	19.31	19.29	19.04	18.3	17.25	16.34	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) =

0.48

(91)

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

(92)m=	17.02	17.51	18.12	18.8	19.4	19.83	20.03	20	19.7	18.91	17.83	16.92	(92)
--------	-------	-------	-------	------	------	-------	-------	----	------	-------	-------	-------	------

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

(93)m=	17.02	17.51	18.12	18.8	19.4	19.83	20.03	20	19.7	18.91	17.83	16.92	(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	
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DFEE WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Utilisation factor for gains, hm:

(94)m=	0.9	0.85	0.79	0.71	0.61	0.49	0.36	0.39	0.56	0.74	0.86	0.91	(94)
--------	-----	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	413.77	515.83	567.98	568.88	512.9	396.29	285.01	293.87	397.52	451.07	416.43	384.48	(95)
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1213.14	1200.43	1104.5	934.32	724.95	489.35	320.47	336.54	525.4	782.93	1013.68	1205.44	(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=	594.73	460.05	399.17	263.12	157.77	0	0	0	0	246.9	430.01	610.79	(98)
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 3162.55 (98)Space heating requirement in kWh/m²/year

65.83 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	879.44	692.33	710.13	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.71	0.77	0.75	0	0	0	0	(101)
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Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	621.55	531.45	531.87	0	0	0	0	(102)
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Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1013.32	979.95	940.7	0	0	0	0	(103)
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Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m

set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	282.07	333.68	304.17	0	0	0	0	(104)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Total = Sum(104) = 919.92 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	(106)
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Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	70.52	83.42	76.04	0	0	0	0	(107)
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	-------

Total = Sum(107) = 229.98 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 4.79 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 70.62 (109)

DER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

User Details:

Assessor Name: Matthew Ray **Stroma Number:** STRO036484
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.51

Property Address: BE2664 - Type 2 - ASHP + PV

Address : Plots 4 - 16, Little Acres, New Barn, Longfield, DA3 7LA

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	48.04 (1a)	2.75 (2a)	132.11 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	48.04 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	132.11 (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) =	0.15 (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]×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <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>			0 (11)
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)			0.4 (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			2 (19)
Shelter factor	(20) = 1 - [0.075 × (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (20) =		0.34 (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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DER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

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

0.44	0.43	0.42	0.38	0.37	0.32	0.32	0.32	0.34	0.37	0.38	0.4
------	------	------	------	------	------	------	------	------	------	------	-----

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 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
Windows Type 1			3.64	$\times 1/[1/(1.4) + 0.04] =$	4.83		(27)
Windows Type 2			2.85	$\times 1/[1/(1.4) + 0.04] =$	3.78		(27)
Windows Type 3			1.89	$\times 1/[1/(1.4) + 0.04] =$	2.51		(27)
Windows Type 4			5.64	$\times 1/[1/(1.4) + 0.04] =$	7.48		(27)
Windows Type 5			2.67	$\times 1/[1/(1.4) + 0.04] =$	3.54		(27)
Windows Type 6			0.42	$\times 1/[1/(1.4) + 0.04] =$	0.56		(27)
Windows Type 7			0.73	$\times 1/[1/(1.4) + 0.04] =$	0.97		(27)
Windows Type 8			1.24	$\times 1/[1/(1.4) + 0.04] =$	1.64		(27)
Floor			48.04	x 0.18 =	8.647201		(28)
Walls	98.59	19.08	79.51	x 0.16 =	12.72		(29)
Roof	48.04	0	48.04	x 0.16 =	7.69		(30)
Total area of elements, m²			194.67				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 54.35 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 960.8 (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 15.12 (36)

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

DER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Total fabric heat loss (33) + (36) = 69.47 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.92	25.76	25.61	24.87	24.73	24.09	24.09	23.97	24.34	24.73	25.01	25.3	(38)

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

(39)m=	95.39	95.23	95.08	94.34	94.2	93.56	93.56	93.44	93.81	94.2	94.48	94.77	
Average = Sum(39) _{1...12} /12=												94.34	(39)

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

(40)m=	1.99	1.98	1.98	1.96	1.96	1.95	1.95	1.95	1.95	1.96	1.97	1.97	
Average = Sum(40) _{1...12} /12=												1.96	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.63 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 72.97 (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=	80.27	77.35	74.43	71.51	68.6	65.68	65.68	68.6	71.51	74.43	77.35	80.27	
Total = Sum(44) _{1...12} =												875.69	(44)

Energy content of hot water used - calculated monthly = 4.190 × Vd,m × nm × DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	119.04	104.11	107.44	93.66	89.87	77.55	71.87	82.47	83.45	97.25	106.16	115.28	
Total = Sum(45) _{1...12} =												1148.16	(45)

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

(46)m=	17.86	15.62	16.12	14.05	13.48	11.63	10.78	12.37	12.52	14.59	15.92	17.29	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.5 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) × (49) = 0.81 (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) × (51) × (52) × (53) = 0 (54)

Enter (50) or (54) in (55) 0.81 (55)

DER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Water storage loss calculated for each month

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

(56)m=

25.11	22.68	25.11	24.3	25.11	24.3	25.11	25.11	24.3	25.11	24.3	25.11
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 (56)

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

(57)m=

25.11	22.68	25.11	24.3	25.11	24.3	25.11	25.11	24.3	25.11	24.3	25.11
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 (57)

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (59)

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

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (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=

167.41	147.8	155.81	140.48	138.25	124.37	120.24	130.84	130.26	145.63	152.97	163.66
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 (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=

167.41	147.8	155.81	140.48	138.25	124.37	120.24	130.84	130.26	145.63	152.97	163.66
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 (64)

Output from water heater (annual)_{1...12}

1717.71

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=

78.28	69.57	74.42	68.59	68.58	63.24	62.59	66.12	65.2	71.04	72.75	77.03
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63

 (66)

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

(67)m=

12.67	11.26	9.15	6.93	5.18	4.37	4.73	6.14	8.24	10.47	12.22	13.02
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 (67)

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

(68)m=

142.15	143.62	139.9	131.99	122	112.61	106.34	104.87	108.58	116.5	126.49	135.87
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 (68)

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

(69)m=

31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

10	10	10	10	10	10	10	10	10	10	10	10
----	----	----	----	----	----	----	----	----	----	----	----

 (70)

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

(71)m=

-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (71)

Water heating gains (Table 5)

(72)m=

105.21	103.53	100.03	95.27	92.18	87.83	84.13	88.87	90.55	95.48	101.04	103.53
--------	--------	--------	-------	-------	-------	-------	-------	-------	-------	--------	--------

 (72)

Total internal gains =

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

(73)m=

317.52	315.89	306.57	291.68	276.85	262.3	252.69	257.37	264.87	279.93	297.23	309.92
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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.

DER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

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	0.42	x	10.63	x	0.63	x	0.7	=	1.36 (74)
North	0.9x	0.77	x	0.73	x	10.63	x	0.63	x	0.7	=	2.37 (74)
North	0.9x	0.77	x	1.24	x	10.63	x	0.63	x	0.7	=	4.03 (74)
North	0.9x	0.77	x	0.42	x	20.32	x	0.63	x	0.7	=	2.61 (74)
North	0.9x	0.77	x	0.73	x	20.32	x	0.63	x	0.7	=	4.53 (74)
North	0.9x	0.77	x	1.24	x	20.32	x	0.63	x	0.7	=	7.7 (74)
North	0.9x	0.77	x	0.42	x	34.53	x	0.63	x	0.7	=	4.43 (74)
North	0.9x	0.77	x	0.73	x	34.53	x	0.63	x	0.7	=	7.7 (74)
North	0.9x	0.77	x	1.24	x	34.53	x	0.63	x	0.7	=	13.09 (74)
North	0.9x	0.77	x	0.42	x	55.46	x	0.63	x	0.7	=	7.12 (74)
North	0.9x	0.77	x	0.73	x	55.46	x	0.63	x	0.7	=	12.37 (74)
North	0.9x	0.77	x	1.24	x	55.46	x	0.63	x	0.7	=	21.02 (74)
North	0.9x	0.77	x	0.42	x	74.72	x	0.63	x	0.7	=	9.59 (74)
North	0.9x	0.77	x	0.73	x	74.72	x	0.63	x	0.7	=	16.67 (74)
North	0.9x	0.77	x	1.24	x	74.72	x	0.63	x	0.7	=	28.31 (74)
North	0.9x	0.77	x	0.42	x	79.99	x	0.63	x	0.7	=	10.27 (74)
North	0.9x	0.77	x	0.73	x	79.99	x	0.63	x	0.7	=	17.84 (74)
North	0.9x	0.77	x	1.24	x	79.99	x	0.63	x	0.7	=	30.31 (74)
North	0.9x	0.77	x	0.42	x	74.68	x	0.63	x	0.7	=	9.59 (74)
North	0.9x	0.77	x	0.73	x	74.68	x	0.63	x	0.7	=	16.66 (74)
North	0.9x	0.77	x	1.24	x	74.68	x	0.63	x	0.7	=	28.3 (74)
North	0.9x	0.77	x	0.42	x	59.25	x	0.63	x	0.7	=	7.6 (74)
North	0.9x	0.77	x	0.73	x	59.25	x	0.63	x	0.7	=	13.22 (74)
North	0.9x	0.77	x	1.24	x	59.25	x	0.63	x	0.7	=	22.45 (74)
North	0.9x	0.77	x	0.42	x	41.52	x	0.63	x	0.7	=	5.33 (74)
North	0.9x	0.77	x	0.73	x	41.52	x	0.63	x	0.7	=	9.26 (74)
North	0.9x	0.77	x	1.24	x	41.52	x	0.63	x	0.7	=	15.73 (74)
North	0.9x	0.77	x	0.42	x	24.19	x	0.63	x	0.7	=	3.1 (74)
North	0.9x	0.77	x	0.73	x	24.19	x	0.63	x	0.7	=	5.4 (74)
North	0.9x	0.77	x	1.24	x	24.19	x	0.63	x	0.7	=	9.17 (74)
North	0.9x	0.77	x	0.42	x	13.12	x	0.63	x	0.7	=	1.68 (74)
North	0.9x	0.77	x	0.73	x	13.12	x	0.63	x	0.7	=	2.93 (74)
North	0.9x	0.77	x	1.24	x	13.12	x	0.63	x	0.7	=	4.97 (74)
North	0.9x	0.77	x	0.42	x	8.86	x	0.63	x	0.7	=	1.14 (74)
North	0.9x	0.77	x	0.73	x	8.86	x	0.63	x	0.7	=	1.98 (74)
North	0.9x	0.77	x	1.24	x	8.86	x	0.63	x	0.7	=	3.36 (74)
South	0.9x	0.77	x	3.64	x	46.75	x	0.63	x	0.7	=	52.01 (78)
South	0.9x	0.77	x	2.85	x	46.75	x	0.63	x	0.7	=	40.72 (78)
South	0.9x	0.77	x	1.89	x	46.75	x	0.63	x	0.7	=	27 (78)

DER WorkSheet: New dwelling design stage*Results and inputs informed by developer declaration. Any deviation is certain to output different results.*

South	0.9x	0.77	x	5.64	x	46.75	x	0.63	x	0.7	=	80.58	(78)
South	0.9x	0.77	x	3.64	x	76.57	x	0.63	x	0.7	=	85.18	(78)
South	0.9x	0.77	x	2.85	x	76.57	x	0.63	x	0.7	=	66.69	(78)
South	0.9x	0.77	x	1.89	x	76.57	x	0.63	x	0.7	=	44.23	(78)
South	0.9x	0.77	x	5.64	x	76.57	x	0.63	x	0.7	=	131.98	(78)
South	0.9x	0.77	x	3.64	x	97.53	x	0.63	x	0.7	=	108.5	(78)
South	0.9x	0.77	x	2.85	x	97.53	x	0.63	x	0.7	=	84.95	(78)
South	0.9x	0.77	x	1.89	x	97.53	x	0.63	x	0.7	=	56.34	(78)
South	0.9x	0.77	x	5.64	x	97.53	x	0.63	x	0.7	=	168.11	(78)
South	0.9x	0.77	x	3.64	x	110.23	x	0.63	x	0.7	=	122.63	(78)
South	0.9x	0.77	x	2.85	x	110.23	x	0.63	x	0.7	=	96.01	(78)
South	0.9x	0.77	x	1.89	x	110.23	x	0.63	x	0.7	=	63.67	(78)
South	0.9x	0.77	x	5.64	x	110.23	x	0.63	x	0.7	=	190.01	(78)
South	0.9x	0.77	x	3.64	x	114.87	x	0.63	x	0.7	=	127.79	(78)
South	0.9x	0.77	x	2.85	x	114.87	x	0.63	x	0.7	=	100.05	(78)
South	0.9x	0.77	x	1.89	x	114.87	x	0.63	x	0.7	=	66.35	(78)
South	0.9x	0.77	x	5.64	x	114.87	x	0.63	x	0.7	=	198	(78)
South	0.9x	0.77	x	3.64	x	110.55	x	0.63	x	0.7	=	122.98	(78)
South	0.9x	0.77	x	2.85	x	110.55	x	0.63	x	0.7	=	96.29	(78)
South	0.9x	0.77	x	1.89	x	110.55	x	0.63	x	0.7	=	63.85	(78)
South	0.9x	0.77	x	5.64	x	110.55	x	0.63	x	0.7	=	190.55	(78)
South	0.9x	0.77	x	3.64	x	108.01	x	0.63	x	0.7	=	120.16	(78)
South	0.9x	0.77	x	2.85	x	108.01	x	0.63	x	0.7	=	94.08	(78)
South	0.9x	0.77	x	1.89	x	108.01	x	0.63	x	0.7	=	62.39	(78)
South	0.9x	0.77	x	5.64	x	108.01	x	0.63	x	0.7	=	186.18	(78)
South	0.9x	0.77	x	3.64	x	104.89	x	0.63	x	0.7	=	116.69	(78)
South	0.9x	0.77	x	2.85	x	104.89	x	0.63	x	0.7	=	91.36	(78)
South	0.9x	0.77	x	1.89	x	104.89	x	0.63	x	0.7	=	60.59	(78)
South	0.9x	0.77	x	5.64	x	104.89	x	0.63	x	0.7	=	180.8	(78)
South	0.9x	0.77	x	3.64	x	101.89	x	0.63	x	0.7	=	113.34	(78)
South	0.9x	0.77	x	2.85	x	101.89	x	0.63	x	0.7	=	88.74	(78)
South	0.9x	0.77	x	1.89	x	101.89	x	0.63	x	0.7	=	58.85	(78)
South	0.9x	0.77	x	5.64	x	101.89	x	0.63	x	0.7	=	175.62	(78)
South	0.9x	0.77	x	3.64	x	82.59	x	0.63	x	0.7	=	91.87	(78)
South	0.9x	0.77	x	2.85	x	82.59	x	0.63	x	0.7	=	71.93	(78)
South	0.9x	0.77	x	1.89	x	82.59	x	0.63	x	0.7	=	47.7	(78)
South	0.9x	0.77	x	5.64	x	82.59	x	0.63	x	0.7	=	142.35	(78)
South	0.9x	0.77	x	3.64	x	55.42	x	0.63	x	0.7	=	61.65	(78)
South	0.9x	0.77	x	2.85	x	55.42	x	0.63	x	0.7	=	48.27	(78)
South	0.9x	0.77	x	1.89	x	55.42	x	0.63	x	0.7	=	32.01	(78)
South	0.9x	0.77	x	5.64	x	55.42	x	0.63	x	0.7	=	95.52	(78)

DER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

South	0.9x	0.77	x	3.64	x	40.4	x	0.63	x	0.7	=	44.94	(78)
South	0.9x	0.77	x	2.85	x	40.4	x	0.63	x	0.7	=	35.19	(78)
South	0.9x	0.77	x	1.89	x	40.4	x	0.63	x	0.7	=	23.33	(78)
South	0.9x	0.77	x	5.64	x	40.4	x	0.63	x	0.7	=	69.63	(78)
West	0.9x	0.77	x	2.67	x	19.64	x	0.63	x	0.7	=	16.03	(80)
West	0.9x	0.77	x	2.67	x	38.42	x	0.63	x	0.7	=	31.35	(80)
West	0.9x	0.77	x	2.67	x	63.27	x	0.63	x	0.7	=	51.63	(80)
West	0.9x	0.77	x	2.67	x	92.28	x	0.63	x	0.7	=	75.3	(80)
West	0.9x	0.77	x	2.67	x	113.09	x	0.63	x	0.7	=	92.28	(80)
West	0.9x	0.77	x	2.67	x	115.77	x	0.63	x	0.7	=	94.47	(80)
West	0.9x	0.77	x	2.67	x	110.22	x	0.63	x	0.7	=	89.94	(80)
West	0.9x	0.77	x	2.67	x	94.68	x	0.63	x	0.7	=	77.25	(80)
West	0.9x	0.77	x	2.67	x	73.59	x	0.63	x	0.7	=	60.05	(80)
West	0.9x	0.77	x	2.67	x	45.59	x	0.63	x	0.7	=	37.2	(80)
West	0.9x	0.77	x	2.67	x	24.49	x	0.63	x	0.7	=	19.98	(80)
West	0.9x	0.77	x	2.67	x	16.15	x	0.63	x	0.7	=	13.18	(80)

Solar gains in watts, calculated for each month

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

(83)m=	224.11	374.26	494.75	588.13	639.04	626.55	607.28	569.97	526.92	408.72	267.01	192.75	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	541.63	690.16	801.33	879.81	915.89	888.86	859.97	827.34	791.79	688.65	564.24	502.67	(84)
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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=	0.91	0.87	0.82	0.74	0.65	0.53	0.41	0.44	0.59	0.77	0.88	0.92	(86)

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

(87)m=	17.84	18.31	18.91	19.58	20.18	20.62	20.83	20.8	20.48	19.69	18.64	17.74	(87)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(88)m=	19.34	19.35	19.35	19.36	19.36	19.37	19.37	19.37	19.37	19.36	19.36	19.35	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.9	0.85	0.79	0.7	0.58	0.43	0.28	0.31	0.5	0.72	0.86	0.91	(89)
--------	-----	------	------	-----	------	------	------	------	-----	------	------	------	------

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

(90)m=	15.41	16.06	16.89	17.8	18.56	19.09	19.29	19.27	18.95	17.98	16.54	15.28	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.48

(91)

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

(92)m=	16.57	17.14	17.85	18.65	19.33	19.82	20.03	20	19.68	18.8	17.54	16.45	(92)
--------	-------	-------	-------	-------	-------	-------	-------	----	-------	------	-------	-------	------

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

(93)m=	16.57	17.14	17.85	18.65	19.33	19.82	20.03	20	19.68	18.8	17.54	16.45	(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	
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--

DER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Utilisation factor for gains, hm:

(94)m=	0.86	0.81	0.75	0.67	0.58	0.46	0.34	0.36	0.52	0.7	0.82	0.88	(94)
--------	------	------	------	------	------	------	------	------	------	-----	------	------	------

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

(95)m=	468.35	560.01	602.37	593.7	529.52	405.79	289.67	299.64	411.18	480.25	463.02	441.2	(95)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1170.49	1165.42	1079.36	919.88	718.88	488.24	320.72	336.82	523.66	772.1	986.25	1161.31	(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=	522.4	406.84	354.88	234.85	140.89	0	0	0	0	217.13	376.73	535.77	(98)
--------	-------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

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

2789.47

Space heating requirement in kWh/m²/year

58.07

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

Fraction of space heat from secondary/supplementary system

0

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

1

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

1

Efficiency of main space heating system 1

175.1

Efficiency of secondary/supplementary heating system, %

0

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

Space heating requirement (calculated above)

522.4	406.84	354.88	234.85	140.89	0	0	0	0	217.13	376.73	535.77
-------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206)

298.34	232.34	202.67	134.12	80.46	0	0	0	0	124	215.15	305.98
--------	--------	--------	--------	-------	---	---	---	---	-----	--------	--------

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

1593.07

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

0

Water heating

Output from water heater (calculated above)

167.41	147.8	155.81	140.48	138.25	124.37	120.24	130.84	130.26	145.63	152.97	163.66
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Efficiency of water heater

175.1

(217)m=

175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	95.61	84.41	88.98	80.23	78.95	71.03	68.67	74.72	74.39	83.17	87.36	93.46	(219)
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Total = Sum(219a)_{1...12} =

980.99

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

1593.07

Water heating fuel used

980.99

Electricity for pumps, fans and electric keep-hot

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Results and inputs informed by developer declaration. Any deviation is certain to output different results.

central heating pump:		120	(230c)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	120	(231)
Electricity for lighting		223.8	(232)
Electricity generated by PVs		-431.81	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2486.05	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	= 826.81 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.519	= 509.13 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1335.94 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 62.28 (267)
Electricity for lighting	(232) x	0.519	= 116.15 (268)
Energy saving/generation technologies Item 1		0.519	= -224.11 (269)
Total CO2, kg/year		sum of (265)...(271) =	1290.26 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	26.86 (273)
El rating (section 14)			81 (274)

TER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

User Details:

Assessor Name: Matthew Ray **Stroma Number:** STRO036484
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.51

Property Address: BE2664 - Type 2 - ASHP + PV

Address : Plots 4 - 16, Little Acres, New Barn, Longfield, DA3 7LA

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	48.04 (1a)	2.75 (2a)	132.11 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	48.04 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	132.11 (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) =	0.15 (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]×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <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>			0 (11)
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)			0.4 (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			2 (19)
Shelter factor	(20) = 1 - [0.075 × (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (20) =		0.34 (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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TER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

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

0.44	0.43	0.42	0.38	0.37	0.32	0.32	0.32	0.34	0.37	0.38	0.4
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0	(23a)
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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	(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	(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	(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)
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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)
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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
Windows Type 1			2.29	$\times 1/[1/(1.4) + 0.04] =$	3.04		(27)
Windows Type 2			1.79	$\times 1/[1/(1.4) + 0.04] =$	2.37		(27)
Windows Type 3			1.19	$\times 1/[1/(1.4) + 0.04] =$	1.58		(27)
Windows Type 4			3.55	$\times 1/[1/(1.4) + 0.04] =$	4.71		(27)
Windows Type 5			1.68	$\times 1/[1/(1.4) + 0.04] =$	2.23		(27)
Windows Type 6			0.26	$\times 1/[1/(1.4) + 0.04] =$	0.34		(27)
Windows Type 7			0.46	$\times 1/[1/(1.4) + 0.04] =$	0.61		(27)
Windows Type 8			0.78	$\times 1/[1/(1.4) + 0.04] =$	1.03		(27)
Floor			48.04	x 0.13 =	6.2452		(28)
Walls	98.59	12	86.59	x 0.18 =	15.59		(29)
Roof	48.04	0	48.04	x 0.13 =	6.25		(30)
Total area of elements, m²			194.67				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 43.99 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 960.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 12.22 (36)

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

TER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Total fabric heat loss (33) + (36) = 56.21 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.92	25.76	25.61	24.87	24.73	24.09	24.09	23.97	24.34	24.73	25.01	25.3	(38)

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

(39)m=	82.13	81.97	81.81	81.07	80.94	80.29	80.29	80.17	80.54	80.94	81.21	81.51	
Average = Sum(39) _{1...12} /12=												81.07	(39)

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

(40)m=	1.71	1.71	1.7	1.69	1.68	1.67	1.67	1.67	1.68	1.68	1.69	1.7	
Average = Sum(40) _{1...12} /12=												1.69	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.63 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 72.97 (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=	80.27	77.35	74.43	71.51	68.6	65.68	65.68	68.6	71.51	74.43	77.35	80.27	
Total = Sum(44) _{1...12} =												875.69	(44)

Energy content of hot water used - calculated monthly = 4.190 × Vd,m × nm × DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	119.04	104.11	107.44	93.66	89.87	77.55	71.87	82.47	83.45	97.25	106.16	115.28	
Total = Sum(45) _{1...12} =												1148.16	(45)

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

(46)m=	17.86	15.62	16.12	14.05	13.48	11.63	10.78	12.37	12.52	14.59	15.92	17.29	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) × (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

TER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Water storage loss calculated for each month

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
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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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
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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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
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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=	165.63	146.2	154.03	138.76	136.47	122.65	118.46	129.06	128.54	143.85	151.25	161.88	(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)
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Output from water heater

(64)m=	165.63	146.2	154.03	138.76	136.47	122.65	118.46	129.06	128.54	143.85	151.25	161.88		
	Output from water heater (annual) _{1...12}												1696.78	(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=	76.86	68.29	73	67.22	67.16	61.86	61.17	64.7	63.82	69.61	71.37	75.61	(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=	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	81.63	(66)

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

(67)m=	12.67	11.26	9.15	6.93	5.18	4.37	4.73	6.14	8.24	10.47	12.22	13.02	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	142.15	143.62	139.9	131.99	122	112.61	106.34	104.87	108.58	116.5	126.49	135.87	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	(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=	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	-65.3	(71)
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Water heating gains (Table 5)

(72)m=	103.3	101.62	98.12	93.36	90.27	85.92	82.22	86.96	88.64	93.57	99.13	101.62	(72)
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Total internal gains =

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

(73)m=	308.61	306.98	297.66	282.77	267.94	253.39	243.77	248.45	255.96	271.02	288.32	301.01	(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.

TER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

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	0.26	x	10.63	x	0.63	x	0.7	= 0.84 (74)
North	0.9x	0.77	x	0.46	x	10.63	x	0.63	x	0.7	= 1.49 (74)
North	0.9x	0.77	x	0.78	x	10.63	x	0.63	x	0.7	= 2.53 (74)
North	0.9x	0.77	x	0.26	x	20.32	x	0.63	x	0.7	= 1.61 (74)
North	0.9x	0.77	x	0.46	x	20.32	x	0.63	x	0.7	= 2.86 (74)
North	0.9x	0.77	x	0.78	x	20.32	x	0.63	x	0.7	= 4.84 (74)
North	0.9x	0.77	x	0.26	x	34.53	x	0.63	x	0.7	= 2.74 (74)
North	0.9x	0.77	x	0.46	x	34.53	x	0.63	x	0.7	= 4.85 (74)
North	0.9x	0.77	x	0.78	x	34.53	x	0.63	x	0.7	= 8.23 (74)
North	0.9x	0.77	x	0.26	x	55.46	x	0.63	x	0.7	= 4.41 (74)
North	0.9x	0.77	x	0.46	x	55.46	x	0.63	x	0.7	= 7.8 (74)
North	0.9x	0.77	x	0.78	x	55.46	x	0.63	x	0.7	= 13.22 (74)
North	0.9x	0.77	x	0.26	x	74.72	x	0.63	x	0.7	= 5.94 (74)
North	0.9x	0.77	x	0.46	x	74.72	x	0.63	x	0.7	= 10.5 (74)
North	0.9x	0.77	x	0.78	x	74.72	x	0.63	x	0.7	= 17.81 (74)
North	0.9x	0.77	x	0.26	x	79.99	x	0.63	x	0.7	= 6.36 (74)
North	0.9x	0.77	x	0.46	x	79.99	x	0.63	x	0.7	= 11.24 (74)
North	0.9x	0.77	x	0.78	x	79.99	x	0.63	x	0.7	= 19.07 (74)
North	0.9x	0.77	x	0.26	x	74.68	x	0.63	x	0.7	= 5.93 (74)
North	0.9x	0.77	x	0.46	x	74.68	x	0.63	x	0.7	= 10.5 (74)
North	0.9x	0.77	x	0.78	x	74.68	x	0.63	x	0.7	= 17.8 (74)
North	0.9x	0.77	x	0.26	x	59.25	x	0.63	x	0.7	= 4.71 (74)
North	0.9x	0.77	x	0.46	x	59.25	x	0.63	x	0.7	= 8.33 (74)
North	0.9x	0.77	x	0.78	x	59.25	x	0.63	x	0.7	= 14.12 (74)
North	0.9x	0.77	x	0.26	x	41.52	x	0.63	x	0.7	= 3.3 (74)
North	0.9x	0.77	x	0.46	x	41.52	x	0.63	x	0.7	= 5.84 (74)
North	0.9x	0.77	x	0.78	x	41.52	x	0.63	x	0.7	= 9.9 (74)
North	0.9x	0.77	x	0.26	x	24.19	x	0.63	x	0.7	= 1.92 (74)
North	0.9x	0.77	x	0.46	x	24.19	x	0.63	x	0.7	= 3.4 (74)
North	0.9x	0.77	x	0.78	x	24.19	x	0.63	x	0.7	= 5.77 (74)
North	0.9x	0.77	x	0.26	x	13.12	x	0.63	x	0.7	= 1.04 (74)
North	0.9x	0.77	x	0.46	x	13.12	x	0.63	x	0.7	= 1.84 (74)
North	0.9x	0.77	x	0.78	x	13.12	x	0.63	x	0.7	= 3.13 (74)
North	0.9x	0.77	x	0.26	x	8.86	x	0.63	x	0.7	= 0.7 (74)
North	0.9x	0.77	x	0.46	x	8.86	x	0.63	x	0.7	= 1.25 (74)
North	0.9x	0.77	x	0.78	x	8.86	x	0.63	x	0.7	= 2.11 (74)
South	0.9x	0.77	x	2.29	x	46.75	x	0.63	x	0.7	= 32.72 (78)
South	0.9x	0.77	x	1.79	x	46.75	x	0.63	x	0.7	= 25.58 (78)
South	0.9x	0.77	x	1.19	x	46.75	x	0.63	x	0.7	= 17 (78)

TER WorkSheet: New dwelling design stage*Results and inputs informed by developer declaration. Any deviation is certain to output different results.*

South	0.9x	0.77	x	3.55	x	46.75	x	0.63	x	0.7	=	50.72	(78)
South	0.9x	0.77	x	2.29	x	76.57	x	0.63	x	0.7	=	53.59	(78)
South	0.9x	0.77	x	1.79	x	76.57	x	0.63	x	0.7	=	41.89	(78)
South	0.9x	0.77	x	1.19	x	76.57	x	0.63	x	0.7	=	27.85	(78)
South	0.9x	0.77	x	3.55	x	76.57	x	0.63	x	0.7	=	83.07	(78)
South	0.9x	0.77	x	2.29	x	97.53	x	0.63	x	0.7	=	68.26	(78)
South	0.9x	0.77	x	1.79	x	97.53	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	1.19	x	97.53	x	0.63	x	0.7	=	35.47	(78)
South	0.9x	0.77	x	3.55	x	97.53	x	0.63	x	0.7	=	105.82	(78)
South	0.9x	0.77	x	2.29	x	110.23	x	0.63	x	0.7	=	77.15	(78)
South	0.9x	0.77	x	1.79	x	110.23	x	0.63	x	0.7	=	60.3	(78)
South	0.9x	0.77	x	1.19	x	110.23	x	0.63	x	0.7	=	40.09	(78)
South	0.9x	0.77	x	3.55	x	110.23	x	0.63	x	0.7	=	119.6	(78)
South	0.9x	0.77	x	2.29	x	114.87	x	0.63	x	0.7	=	80.39	(78)
South	0.9x	0.77	x	1.79	x	114.87	x	0.63	x	0.7	=	62.84	(78)
South	0.9x	0.77	x	1.19	x	114.87	x	0.63	x	0.7	=	41.78	(78)
South	0.9x	0.77	x	3.55	x	114.87	x	0.63	x	0.7	=	124.63	(78)
South	0.9x	0.77	x	2.29	x	110.55	x	0.63	x	0.7	=	77.37	(78)
South	0.9x	0.77	x	1.79	x	110.55	x	0.63	x	0.7	=	60.47	(78)
South	0.9x	0.77	x	1.19	x	110.55	x	0.63	x	0.7	=	40.2	(78)
South	0.9x	0.77	x	3.55	x	110.55	x	0.63	x	0.7	=	119.94	(78)
South	0.9x	0.77	x	2.29	x	108.01	x	0.63	x	0.7	=	75.59	(78)
South	0.9x	0.77	x	1.79	x	108.01	x	0.63	x	0.7	=	59.09	(78)
South	0.9x	0.77	x	1.19	x	108.01	x	0.63	x	0.7	=	39.28	(78)
South	0.9x	0.77	x	3.55	x	108.01	x	0.63	x	0.7	=	117.18	(78)
South	0.9x	0.77	x	2.29	x	104.89	x	0.63	x	0.7	=	73.41	(78)
South	0.9x	0.77	x	1.79	x	104.89	x	0.63	x	0.7	=	57.38	(78)
South	0.9x	0.77	x	1.19	x	104.89	x	0.63	x	0.7	=	38.15	(78)
South	0.9x	0.77	x	3.55	x	104.89	x	0.63	x	0.7	=	113.8	(78)
South	0.9x	0.77	x	2.29	x	101.89	x	0.63	x	0.7	=	71.31	(78)
South	0.9x	0.77	x	1.79	x	101.89	x	0.63	x	0.7	=	55.74	(78)
South	0.9x	0.77	x	1.19	x	101.89	x	0.63	x	0.7	=	37.05	(78)
South	0.9x	0.77	x	3.55	x	101.89	x	0.63	x	0.7	=	110.54	(78)
South	0.9x	0.77	x	2.29	x	82.59	x	0.63	x	0.7	=	57.8	(78)
South	0.9x	0.77	x	1.79	x	82.59	x	0.63	x	0.7	=	45.18	(78)
South	0.9x	0.77	x	1.19	x	82.59	x	0.63	x	0.7	=	30.03	(78)
South	0.9x	0.77	x	3.55	x	82.59	x	0.63	x	0.7	=	89.6	(78)
South	0.9x	0.77	x	2.29	x	55.42	x	0.63	x	0.7	=	38.78	(78)
South	0.9x	0.77	x	1.79	x	55.42	x	0.63	x	0.7	=	30.32	(78)
South	0.9x	0.77	x	1.19	x	55.42	x	0.63	x	0.7	=	20.15	(78)
South	0.9x	0.77	x	3.55	x	55.42	x	0.63	x	0.7	=	60.12	(78)

TER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

South	0.9x	0.77	x	2.29	x	40.4	x	0.63	x	0.7	=	28.27	(78)
South	0.9x	0.77	x	1.79	x	40.4	x	0.63	x	0.7	=	22.1	(78)
South	0.9x	0.77	x	1.19	x	40.4	x	0.63	x	0.7	=	14.69	(78)
South	0.9x	0.77	x	3.55	x	40.4	x	0.63	x	0.7	=	43.83	(78)
West	0.9x	0.77	x	1.68	x	19.64	x	0.63	x	0.7	=	10.08	(80)
West	0.9x	0.77	x	1.68	x	38.42	x	0.63	x	0.7	=	19.73	(80)
West	0.9x	0.77	x	1.68	x	63.27	x	0.63	x	0.7	=	32.49	(80)
West	0.9x	0.77	x	1.68	x	92.28	x	0.63	x	0.7	=	47.38	(80)
West	0.9x	0.77	x	1.68	x	113.09	x	0.63	x	0.7	=	58.07	(80)
West	0.9x	0.77	x	1.68	x	115.77	x	0.63	x	0.7	=	59.44	(80)
West	0.9x	0.77	x	1.68	x	110.22	x	0.63	x	0.7	=	56.59	(80)
West	0.9x	0.77	x	1.68	x	94.68	x	0.63	x	0.7	=	48.61	(80)
West	0.9x	0.77	x	1.68	x	73.59	x	0.63	x	0.7	=	37.78	(80)
West	0.9x	0.77	x	1.68	x	45.59	x	0.63	x	0.7	=	23.41	(80)
West	0.9x	0.77	x	1.68	x	24.49	x	0.63	x	0.7	=	12.57	(80)
West	0.9x	0.77	x	1.68	x	16.15	x	0.63	x	0.7	=	8.29	(80)

Solar gains in watts, calculated for each month

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

(83)m=	140.98	235.43	311.22	369.94	401.95	394.09	381.97	358.51	331.45	257.11	167.96	121.25	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	449.59	542.41	608.88	652.71	669.89	647.48	625.74	606.97	587.41	528.12	456.28	422.26	(84)
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7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.83	0.69	0.53	0.57	0.77	0.93	0.98	0.99	(86)

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

(87)m=	19.36	19.6	19.93	20.32	20.65	20.88	20.97	20.96	20.81	20.37	19.79	19.31	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.53	19.54	19.54	19.55	19.55	19.56	19.56	19.56	19.56	19.55	19.55	19.54	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.97	0.94	0.88	0.77	0.57	0.37	0.41	0.66	0.89	0.97	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.43	17.79	18.26	18.8	19.24	19.49	19.55	19.55	19.43	18.89	18.07	17.37	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.48

(91)

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

(92)m=	18.35	18.65	19.05	19.52	19.91	20.15	20.23	20.22	20.09	19.6	18.89	18.3	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	------

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

(93)m=	18.35	18.65	19.05	19.52	19.91	20.15	20.23	20.22	20.09	19.6	18.89	18.3	(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
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TER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Utilisation factor for gains, hm:

(94)m=	0.98	0.96	0.94	0.88	0.79	0.63	0.45	0.48	0.71	0.89	0.97	0.98	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	441.16	523.19	570.12	576.21	526.73	405.01	282.25	294.37	414.81	472.52	440.87	415.81	(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=	1154.01	1127.17	1027.11	861.39	664.68	445.97	291.18	306.32	482.36	728.34	957.36	1149.05	(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=	530.36	405.88	340	205.33	102.63	0	0	0	0	190.33	371.88	545.53	(98)
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

2691.95

Space heating requirement in kWh/m²/year

56.04 (99)

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

Fraction of space heat from secondary/supplementary system

0 (201)

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

1 (202)

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

1 (204)

Efficiency of main space heating system 1

93.5 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

530.36	405.88	340	205.33	102.63	0	0	0	0	190.33	371.88	545.53
--------	--------	-----	--------	--------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206)

567.23	434.09	363.64	219.6	109.77	0	0	0	0	203.56	397.73	583.46
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Total (kWh/year) = Sum(211)_{1...5,10...12} =

2879.09 (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	(215)
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Total (kWh/year) = Sum(215)_{1...5,10...12} =

0

Water heating

Output from water heater (calculated above)

165.63	146.2	154.03	138.76	136.47	122.65	118.46	129.06	128.54	143.85	151.25	161.88
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Efficiency of water heater

79.8 (216)

(217)m=	87.7	87.4	86.87	85.86	84.07	79.8	79.8	79.8	79.8	85.56	87.12	87.81	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	188.86	167.28	177.31	161.61	162.33	153.69	148.45	161.73	161.08	168.12	173.61	184.36	(219)
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Total = Sum(219a)_{1...12} =

2008.45

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

2879.09

Water heating fuel used

2008.45

Electricity for pumps, fans and electric keep-hot

TER WorkSheet: New dwelling design stage

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75	(231)
Electricity for lighting		223.8	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5186.33	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 621.88 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 433.82 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1055.71 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 116.15 (268)
Total CO2, kg/year	sum of (265)...(271) =		1210.78 (272)
TER =			37.29 (273)

SAP 2012 Overheating Assessment

Results and inputs informed by developer declaration. Any deviation is certain to output different results.
Calculated by Stroma FSAP 2012 program, produced and printed on 27 January 2022

Property Details: BE2664 - Type 2 - ASHP + PV

Dwelling type:	Detached Bungalow
Located in:	England
Region:	South East England
Cross ventilation possible:	Yes
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	6 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	261.58	(P1)
Transmission heat loss coefficient:	69.5	
Summer heat loss coefficient:	331.05	(P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South (Master)	0	1
South (Hall)	0	1
South (Kitchen)	0	1
South (Living)	0	1
West (Living)	0	1
North (Bathroom)	0	1
North (Bedroom 2)	0	1
North (Living)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South (Master)	1	0.9	1	0.9	(P8)
South (Hall)	1	0.9	1	0.9	(P8)
South (Kitchen)	1	0.9	1	0.9	(P8)
South (Living)	1	0.9	1	0.9	(P8)
West (Living)	1	0.9	1	0.9	(P8)
North (Bathroom)	1	0.9	1	0.9	(P8)
North (Bedroom 2)	1	0.9	1	0.9	(P8)
North (Living)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains
South (Master)	0.9 x	3.64	118.4	0.63	0.7	0.9	153.95
South (Hall)	0.9 x	2.85	118.4	0.63	0.7	0.9	120.54
South (Kitchen)	0.9 x	1.89	118.4	0.63	0.7	0.9	79.93
South (Living)	0.9 x	5.64	118.4	0.63	0.7	0.9	238.53
West (Living)	0.9 x	2.67	124.8	0.63	0.7	0.9	119.03
North (Bathroom)	0.9 x	0.42	86.66	0.63	0.7	0.9	13
North (Bedroom 2)	0.9 x	0.73	86.66	0.63	0.7	0.9	22.6
North (Living)	0.9 x	1.24	86.66	0.63	0.7	0.9	38.38

SAP 2012 Overheating Assessment

Results and inputs informed by developer declaration. Any deviation is certain to output different results.

Total 785.96 **(P3/P4)**

Internal gains:

	June	July	August
Internal gains	345.92	333.74	339.82
Total summer gains	1167.75	1119.7	1079.68 (P5)
Summer gain/loss ratio	3.53	3.38	3.26 (P6)
Mean summer external temperature (South East England)	15.4	17.4	17.5
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.23	22.08	22.06 (P7)
Likelihood of high internal temperature	Not significant	Medium	Medium

Assessment of likelihood of high internal temperature: Medium